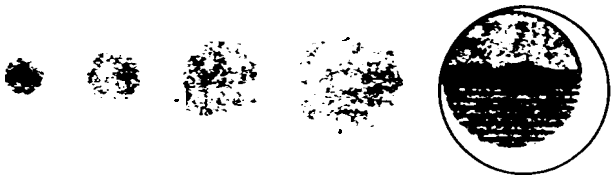

WATER BUDGET CENTER
COLUMBIA BASIN FISH 8 WILDLIFE AGENCIES ● TRIBES

1985 ANNUAL REPORT FROM THE WATER BUDGET MANAGERS

TO

THE NORTHWEST POWER PLANNING COUNCIL

AND

BONNEVILLE POWER ADMINISTRATION

November 1, 1985

E. BURNSIDE STREET ● SUITE 210 ● PORTLAND OR 97214 ● (503)230-4099

1985

ANNUAL, REPORT

FROM

THE WATER BUDGET MANAGERS

This report is to fulfill the annual Water Budget Center reporting requirements to the Northwest Power Planning Council under its Columbia River Basin Fish and Wildlife Program, and the annual reporting requirements to the Bonneville Power Administration under its funding contracts which supported this work.

Mark W. Maher,
Water Budget Manager
Fish & Wildlife Agencies

Malcolm H. Karr,
Water Budget Manager
Columbia Basin Tribes

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1985 WATER BUDGET MANAGERS ANNUAL REPORT

I. INTRODUCTION

1985 was the third year of operation of the Water Budget Center under the guidance and supervision of the fishery agencies and tribal Water Budget Managers, and the second year of formal water budget implementation. The first year, 1983, was considered a trial year because the water budget had not yet been incorporated as a firm constraint into the regional coordinated plan of operation for power production.

In addition to management of the Water Budget, the Water Budget Managers directed the Smolt Monitoring and Water Budget Evaluation Programs of Section 304(d) of the Fish and Wildlife Program. The fishery agencies and tribes also authorized the Water Budget Managers to coordinate agency and tribal system operational requests throughout the year, including spill management for fish passage. Thus the Water Budget Managers, with their supporting staff at the Water Budget Center, work to implement policies and priorities of the state and federal fishery agencies and Indian tribes in carrying out applicable measures of the Fish and Wildlife Program.

This report summarizes Water Budget Manager activities in implementing program measures, including 1985 flow conditions, water budget usage and spill management and problems encountered, and the 1985 Smolt Monitoring Program and preliminary results.

Each year of program implementation has uncovered new facets of system operations for fish, and new problems not anticipated from the previous year's experience. "Recommendations" have been added to this report to identify actions needed to overcome the major obstacles to successful program implementation encountered by the Water Budget Managers in 1985.

II. 1985 RUNOFF

The Sorthwest Power Planning Council's Fish and Wildlife program requires this report to include:

(a) The actual flows achieved for that calendar year;

(B) A record of the estimated number of smolts which passed Lower Granite and Priest Rapids dams, and the period of time over which the migration occurred; and

(C) a description of the flow shaping used for that calendar year to achieve improved smolt survival.

Each of these activities is dependent upon the manner in which the natural runoff from the previous winter's snow pack occurs, and the amount of precipitation during the runoff period. The following is a discussion of the 1985 runoff and a brief discussion of the resultant stream flows. A more thorough discussion of stream flows appears in Section III of this report.

A. Runoff Volumes

The 20-year period of 1961 through 1980 recently was adopted by the Columbia bASIN Water Management Group as the basis for determining the average January through July (Jan-Jul) seasonal runoff. Other comparisons commonly in use are with the shorter term of 1963-1977 or 1970-1985, and the longer term 50 years of 1929-1978. Listed below are the averages in million acre-feet (MAF) for Jan-.Jul runoff above The Dalles for each of these different periods of record, and the actual observed 1985 runoff.

Average Jan-Jul Runoff Above The Dalles, MAF

1961-1980 (20 years)	1963-1977 (15 years)	1970-1985 (.16 years)	1929-1978 (50 years)	1985 Actual
107.0	109.6	109.93	102.7	87.7

The 1985 actual Jan-Jul runoff above The Dalles was 82% of the 1961-1980 (20-year) average. Runoff above Grand Coulee contributing to the 1985 Jan-Jul total was 52.1 MAF (92% of the 2O-year average). Above Lower Granite the contributing Jan-Jul runoff was 25.2 MAF (83.8% of the 20-year average).

B. Runoff Forecasts

The Water Management Group designates the April 1 forecast each year as the "official" Jan-Jul runoff forecast for the year. The 1985 official forecasts and comparisons with actual Jan-Jul runoff were as follows:

	April 1 forecast	% of Actual
The Dalles	98.6	112
Grand Coulee	56.2	108
Lower Granite	30.7	122

The April 1 forecast for the Jan-July period anticipated total runoff at The Dalles to be substantially more than actually occurred. The reason for this discrepancy between forecast and actual in 1985 can be explained mainly by the lack of precipitation throughout the spring and summer periods. Forecasts, such as the April 1, assume that normal precipitation will occur throughout the duration of the forecast period rather than the much below normal precipitation that acutally occurred.

Figure 1 compares the forecasted and actual runoff and notes the percent difference between the two numbers at The Dalles. The actual runoff consistently remained lower than the forecasted runoff throughout the period. This forecast error in the January-March period, as stated above, resulted from the actual precipitation deviating from the assumed normal precipitation. The National Weather Service (NWS) reports that later in the season (April on), forecasts are expected to have greater accuracy because the snow accumulation season is generally over, and maximum water content of the snow packs are known.

7. 1985 Lower Granite Water Budget. Requests from the Water Budget managers for flow at Lower Granite (LWG) will be met first from uncontrolled runoff, then from Dworshak (DWR) and Brownlee (BRN) storage under the following conditions:

a. Idaho Power Company (IPC) may consider the use of BRN storage up to the end of May to meet Water Budget requests if it appears it would not jeopardize operation or refill and if IPC is compensated for any power loss that might occur due to such releases. A detailed procedure for accomplishing this action is still in process.

b. Interpolating enclosure 3 for the latest 1985 LWG runoff forecast of 25.1 MAF indicates that no water shapeable for Water Budget is needed from DWR. Augmentation from DWR to provide extended flows up to 140 kcfs at LWG may be made if DWR refill is not jeopardized. Enclosure 3 is based on studies of water budget implementation procedures made by the Corps and coordinated with the Water Budget managers and others during the past years. Under current conditions it is estimated that the flow at LWG will average over 100 kcfs during the 15 April to 15 June period. The Corps agrees to use any available flexibility at Dworshak and Brownlee to assist in providing average daily flows at LWG of at least 85 kcfs during the migration period.

c. The RCC and Water Budget Managers will jointly monitor the runoff and juvenile migration and may, by mutual agreement, modify the minimum level of flow if needed at LWG.

SEASONAL
WATER SUPPLY FORECASTS
ISSUED BY
NATIONAL WEATHER SERVICE
NORTHWEST RIVER FORECAST CENTER
PORTLAND OREGON

MAR 85 FINAL 1 W A T E R S U P P L Y F O R E C A S T S

STREAM AND STATION	PERIOD	FORECAST	% AVERAGE	AVERAGE
COLUMBIA RIVER				
MICA RESERVOIR INFLOW, BC	FEB-SEP	12500.0	93	13400.
	APR-SEP	12000.0	92	12980.
ARROW LAKES INFLOW	FEB-SEP	25300.0	94	27000.
	APR-SEP	24100.0	93	25900.
BIRCHBANK, BC	APR-SEP	41500.0	93	44610.
GRAND COULEE, WA	JAN-JUL	59900.0	92	64840.
	APR-SEP	63400.0	95	66840.
ROCK ISLAND DAM BLO, WA	APR-SEP	70000.0	96	72780.
THE DALLES NR, OR	APR-SEP	102000.0	101	101000.
	JAN-JUL	105000.0	98	106900.
KOOTENAI RIVER				
LIBBY RESERVOIR INFLOW, MT	APR-SEP	6270.0	89	7041.
KOOTENAY RIVER				
KOOTENAY LAKE INFLOW, BC	APR-SEP	15300.0	90	17090.
DUNCAN RIVER				
DUNCAN RESERVOIR INFLOW, BC	FEB-SEP	2100.0	89	2354.
	APR-SEP	2040.0	90	2274.
CLARK FORK				
ST. REGIS, MT	APR-SEP	3990.0	90	4411.
PEND OREILLE RIVER				
PEND OREILLE LAKE IN, ID	APR-SEP	14400.0	95	15150.
S.F. FLATHEAD RIVER				
HUNGRY HORSE RES INFLOW, MT	APR-SEP	2310.0	101	2278.
FLATHEAD RIVER				
FLATHEAD LAKE INFLOW, MT	APR-SEP	6930.0	95	7270.
COEUR D'ALENE RIVER				
COEUR D'ALENE LAKE IN, ID	APR-SEP	3190.0	112	2849
OKANAGAN RIVER				
TONASKET NR, WA	APR-SEP	1690.0	103	1644.
CHELAN RIVER				
LAKE CHELAN INFLOW, WA	APR-SEP	1150.0	96	1202.
YAKIMA RIVER				
PARKER NR, WA	APR-SEP	1970.0	94	2096.
SKAGIT RIVER				
CONCRETE NR, WA	APR-SEP	6580.0	98	6724.
COWLITZ RIVER				
MAYFIELD RES INFLOW, WA	APR-SEP	2100.0	103	2038.
	APR-JUL	1830.0	103	1778.
CASTLE ROCK, WA	APR-SEP	2700.0	101	2673.
SNAKE RIVER				
JACKSON LAKE INFLOW, WY	APR-JUL	721.0	91	788.
PALISADES RES INFLOW, ID	APR-JUL	2890.0	89	3254.
HEISE NR, ID	APR-JUL	3070.0	89	3465.
WEISER, ID	APR-JUL	6830.0	130	5254.
BROWNLEE RES INFLOW	APR-JUL	7490.0	135	5556.
LOWER GRANITE RES IN, WA	JAN-JUL	32400.0	108	30090.
	APR-JUL	25100.0	113	22140.
TETON RIVER				
ST. ANTHONY NR, ID	APR-JUL	356.0	95	375.
HENRYS FORK				
REXBURG NR, ID	APR-JUL	1110.0	97	1140
BIG LOST RIVER				
MACKAY RESERVOIR INFLOW, ID	APR-JUL	129.0	84	153.

Encl 1.

BIG WOOD RIVER				
HAILEY, ID	APR-JUL	239.0	94	255.
MAGIC RESERVOIR INFLOW, ID	APR-JUL	271.0	92	293.
LITTLE WOOD RIVER				
CAREY NR, ID	APR-JUL	79.0	85	93.
DESCHUTES RIVER				
BENHAM FALLS, OR	APR-SEP	574.0	106	540.
OWYHEE RIVER				
OWYHEE RES INFLOW, OR	MAR-JUL	546.0	109	495.
BOISE RIVER				
BOISE NR, ID	APR-JUL	1380.0	95	1454.
MALHEUR RIVER				
DREWSEY NR, OR	MAR-JUL	100.0	110	91.
N.F. MALHEUR RIVER				
BEULAH RESERVOIR INFLOW, OR	MAR-JUL	77.0	108	71.
PAYETTE RIVER				
HORSESHOE BEND NR, ID	APR-JUL	1640.0	98	1668.
WEISER RIVER				
WEISER NR, ID	APR-JUL	419.0	105	399.
POWDER RIVER				
SUMPTER NR, OR	MAR-JUL	65.0	100	65.
SALMON RIVER				
WHITEBIRD, ID	APR-JUL	6090.0	98	6211.
GRANDE RONDE RIVER				
LA GRANDE, OR	MAR-JUL	191.0	96	198.
TROY, OR	MAR-JUL	1650.0	113	1454.
CLEARWATER RIVER				
OROFINO, ID	APR-JUL	5360.0	109	4917.
N.F. CLEARWATER RIVER				
DWORSHAK RES INFLOW, ID	APR-JUL	2860.0	102	2805.
	APR-SEP	3070.0	103	2985.
CLEARWATER RIVER				
SPALDING, ID	APR-JUL	8640.0	108	8000.
	APR-SEP	9090.0	107	8460.
UMATILLA RIVER				
GIBBON NR, OR	APR-JUL	75.0	106	71.
PENDLETON, OR	APR-JUL	141.0	100	141.
S.F. WALLA WALLA RIVER				
MILTON NR, OR	APR-JUL	56.0	104	54.
M.F. JOHN DAY RIVER				
RITTER, OR	APR-JUL	112.0	104	108.
JOHN DAY RIVER				
SERVICE CREEK, OR	APR-SEP	1000.0	131	764.
CROOKED RIVER				
PRINEVILLE RES INFLOW, OR	MAR-JUL	211.0	147	144.
OCHOCO CREEK				
OCHOCO RES INFLOW, OR	MAR-JUL	39.0	170	23.
S. SANTIAM RIVER				
WATERLOO, OR	APR-SEP	636.0	110	578.
N. SANTIAM RIVER				
MEHAMA, OR	APR-SEP	926.0	111	838.
WILLAMETTE RIVER				
SALEM, OR	APR-SEP	4750.0	102	4655.
CLACKAMAS RIVER				
ESTACADA, OR	APR-SEP	859.0	112	767.
MCKENZIE RIVER				
VIDA NR, OR	APR-SEP	1250.0	104	1207.

THESE FORECASTS ARE SELECTED FROM THOSE PREPARED BY: NATIONAL WEATHER SERVICE, SOIL CONSERVATION SERVICE AND THE B.C. HYDRO AND POWER AUTHORITY. FOR VARIOUS PROJECT INFLOWS, THE FORECASTS HAVE BEEN COORDINATED WITH THE COLUMBIA RIVER FORECAST SERVICE AND THE U.S. BUREAU OF RECLAMATION.

ALL FORECASTS ARE IN THOUSANDS OF ACRE-FEET

ALL AVERAGES ARE FOR THE PERIOD 1961 THROUGH 1980

END [illegible] SANC THUEST DEC

PEAK FLOW AND CREST STAGE FORECASTS (COLUMBIA BASIN)
ISSUED BY
NOAA, NATIONAL WEATHER SERVICE, NORTHWEST RIVER FORECAST CENTER
ISSUED ON MARCH 11 , 1985

STREAM AND STATION	FLOOD STAGE (FEET)	PROBABLE RANGE STAGE (FEET)			PEAK FLOW (KCFS)	
COLUMBIA RIVER						
PRIEST RAPIDS, WASH	422		TO		200	260
THE DALLES			TO		330	410
VANCOUVER	16	13	TO	16		
WILLAMETTE RIVER						
PORTLAND, OREG.	18	12.5	TO	15.5		
KOOTENAI RIVER						
BONNER S FERRY, ID.	74	60	TO	62	20	38
CLARK FORK						
MISSOULA (ABV), MT.	11	7.5	TO	11.0	10.7	20.5
ST. REGIS, MT.	19	14	TO	16.5	31.3	44.0
FLATHEAD RIVER						
COLUMBIA FALLS, MT.	13	12	TO	14	37.4	51.4
PEND OREILLE RIVER						
NEWPORT, WASH.	106,000CFS		TO		56	76
SPOKANE RIVER						
SPOKANE, WA.	27	25	TO	27	25.2	32.0
OKANOGAN RIVER						
TONASKET, WA.	15	13.5	TO	15.5	14.8	21.3
WENATCHEE RIVER						
PESHASTIN, WA.	13	9.5	TO	12.0	13.8	19.8
YAKIMA RIVER						
PARKER (NR), WA.	10	7.5	TO	9.5	7.6	14.0
SNAKE RIVER						
LOWER GRANITE, WA.	--		TO		160	230
HENRYS FORK						
REXBURG, ID.	9	8.5	TO	9.5	5.8	8.2
PAYETTE RIVER						
EMMETT, ID.	16,000 CFS		TO		11.8	15.0
SALMON RIVER						
WHITEBIRD, ID.	32	26.5	TO	29.5	59	79
CLEARWATER RIVER						
SPALDING, ID.	18	13	TO	15.5	58	82
SILVIES R.						
BURNS	9	8.0	TO	8.5	1.55	2.05

MALHEUR LAKE PEAK ELEVATION FORECAST

MALHEUR LAKE WAS AT AN ELEVATION OF 4102.00 AS OF FEBRUARY 27, 1985. THE CURRENT FORECAST FOR PEAK WATER SURFACE ELEVATION THIS YEAR IS 4102.75, TO OCCUR IN JUNE. THIS IS DOWN 0.5 FEET FROM THE PREVIOUS FORECAST DUE TO A LOWER EXPECTED RUNOFF VOLUME THAN WAS PREVIOUSLY FORECAST. THE LAKE WILL COVER APPROXIMATELY 182,000 ACRES AT THIS ELEVATION.

THUS FAR IN THE WATER YEAR (OCTOBER THROUGH FEBRUARY), PRECIPITATION IN THE AREA HAS BEEN 93% OF AVERAGE, WHILE MARCH 1 SNOWPACK IS APPROXIMATELY 130% OF AVERAGE. CURRENT RUNOFF FORECASTS FOR THE MALHEUR LAKE DRAINAGE BASIN ARE 123% OF AVERAGE, ASSUMING AVERAGE PRECIPITATION FOR THE REMAINDER OF THE RUNOFF SEASON.

Encl 2

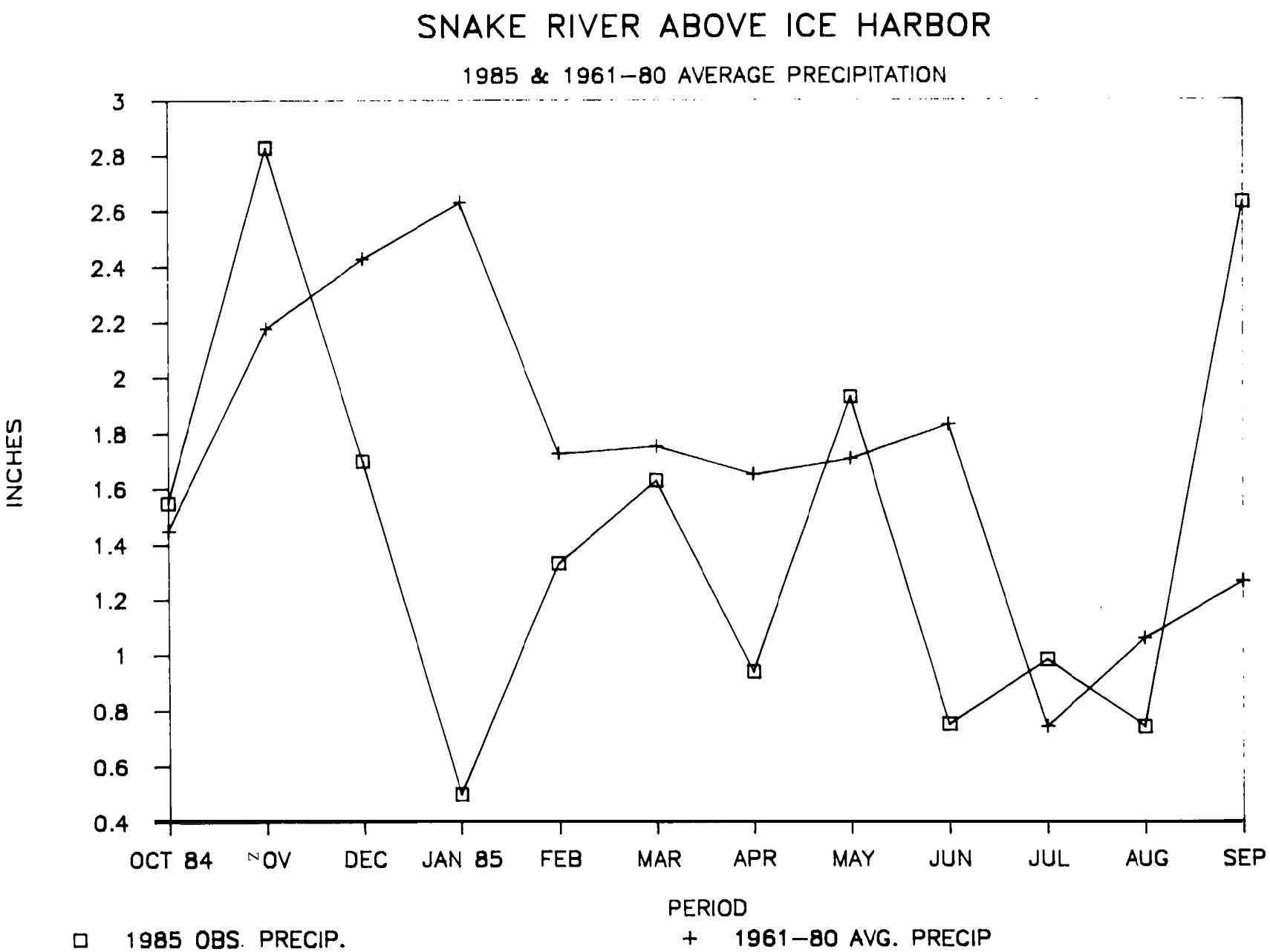

SNAKE RIVER ABOVE ICE HARBOR
1985 & 1961–80 AVERAGE PRECIPITATION
INCHES
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
OCT 84
NOV
DEC
JAN 85
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
PERIOD
□ 1985 OBS. PRECIP.
+ 1961–80 AVG. PRECIP

FIGURE 4

D. Stream Flows

The monthly average streamflows at The Dalles, Lower Granite and Grand Coulee are plotted in Figures 5, 6, and 7. Also shown are the 50-year average (1929-78) monthly flows at these three stations for comparison. Starting in January, streamflows were substantially below the 50-year average. Flows were close to average in April, then dropped substantially below normal during the spring refill period. These lower flows are a direct result of below normal precipitation throughout the period.

THE DALLES

1985 & 1928-78 MONTHLY AVERAGE FLOWS

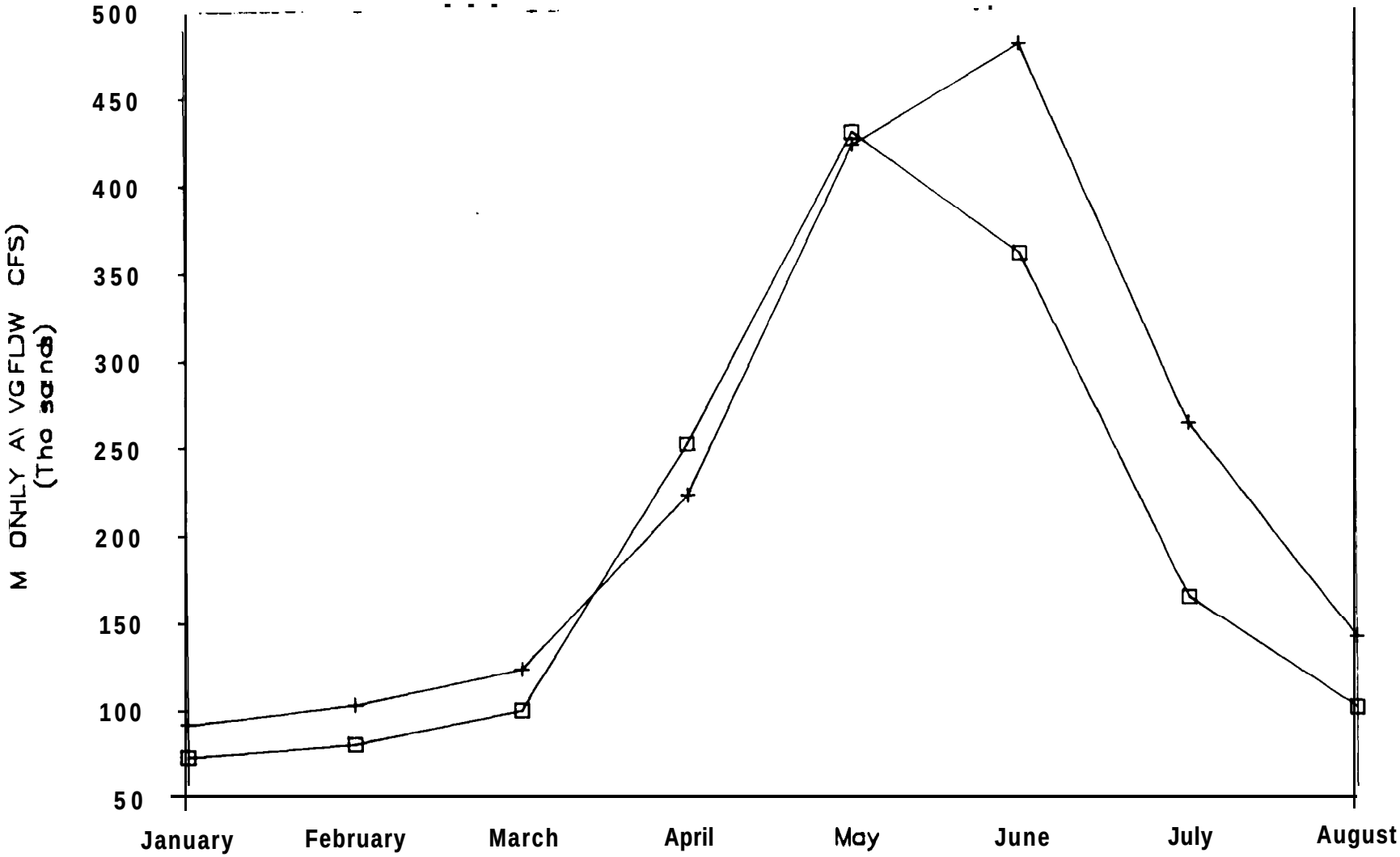
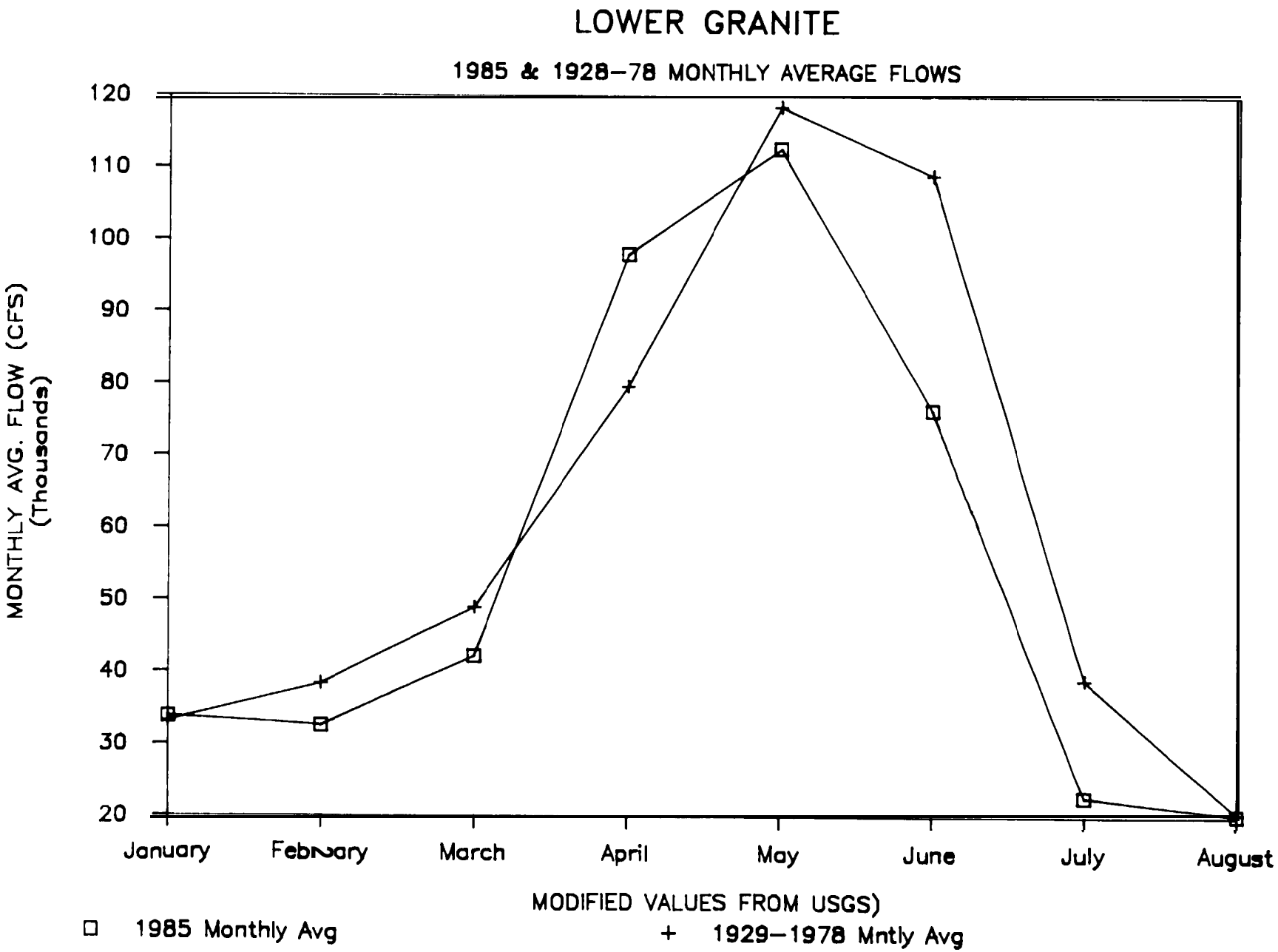


FIGURE 5


LOWER GRANITE
1985 & 1928–78 MONTHLY AVERAGE FLOWS
MONTHLY AVG. FLOW (CFS)
(Thousands)
120
110
100
90
80
70
60
50
40
30
20
January
February
March
April
May
June
July
August
MODIFIED VALUES FROM USGS)
1985 Monthly Avg
1929–1978 Mntly Avg

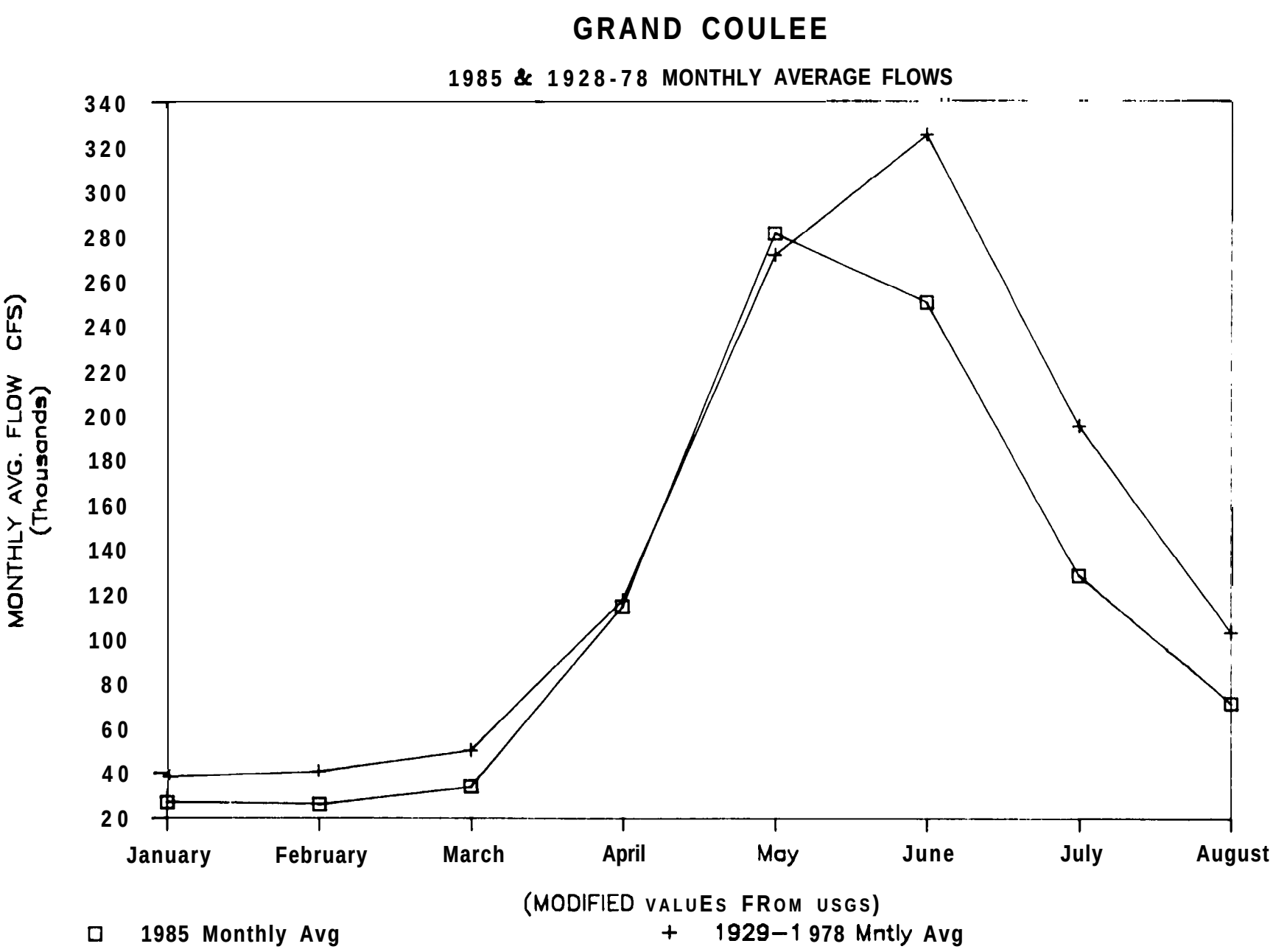

GRAND COULEE
1985 & 1928-78 MONTHLY AVERAGE FLOWS
MONTHLY AVG. FLOW CFS)
(Thousands)
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
January
February
March
April
May
June
July
August
(MODIFIED VALUES FROM USGS)
1985 Monthly Avg
1929–1978 Mntly Avg

FIGURE 7

III. 1985 WATER BUDGET AND OTHER FLOW OPERATIONS

Prior to the 1985 water budget period, the Corps, BPA, PUDs, BR, fishery agencies and tribes agreed on a Coordinated Plan of Operation (CPO) for April 15 through June 15, 1985. (Appendix A)

The CPO addressed water budget implementation in the Snake and mid-Columbia Rivers. The plan was based on March 1 runoff forecasts with some departure from the Northwest Power Planning Council Fish and Wildlife Program (Program) measures in an attempt to eliminate areas of disagreement regarding program implementation that became apparent during the previous two years.

A. Snake River Water Budget

The plan agreed to on a trial basis for both 1984 and 1985 in the Snake River specified the volume contribution to the Water Budget from Dworshak, and tentatively from Brownlee, depending upon the March 1 runoff forecast for Lower Granite Dam (LWG) and Brownlee Dam. As it turned out, the March 1 forecast was greater than the level that committed either of these two reservoirs to participate, and it was estimated that flows from uncontrolled runoff at LWG would average over 100 kcfs during the April 15 through June 15 period. Therefore, there was no water shapeable for water budget purposes in accordance with the Coordinated Plan of Operation (see Appendix A).

However, in recognition that even during an above average runoff year, flows at LWG could at times drop below the 85 kcfs minimum for fish, the Corps agreed to use any available flexibility at Dworshak and Brownlee to keep average daily flows at LWG above 85 kcfs during the migration period. Idaho Power Co., however, made no commitment at Brownlee.

The actual flows and corresponding fish passage which occurred at Lower Granite Dam are shown on Figure 8. During the 60-day water budget period from April 15 through June 15, flows at LWG were below the agreed upon 85 kcfs for 22 days. On one day during a 11 consecutive day period below the fishery minimum, the average flow was only 53 kcfs. Figure 8 indicates that passage followed flows at Lower Granite in 1985.

Figure 9 shows flows which occurred at LWG in 1985 versus those which occurred in 1984. Flows were consistently lower in 1985. Correspondingly, passage conditions are considered to have been less favorable in 1985 than in 1984.

These low flows were caused by a combination of problems. First, as discussed in Section II of this report, natural runoff measured at LWG turned out to be less than average, although the early forecasts were for higher than average runoff. Secondly, flood control operations, based upon early forecasts of runoff, evacuated Dworshak and Brownlee. Third, Idaho Power Company (IPCo) did not make a pre-season commitment to provide supplemental water. During the spring when flows were low, IPCo, claiming that Brownlee reservoir was drawn unnecessarily low for flood control and might not refill, repeatedly refused to provide supplemental flows. (Appendix B). Fourth, the COE did not use all available flexibility at Dworshak to assist in meeting flow requests. What the COE did supply was water above the assured refill curve. The COE was not willing to lower the probability of refill, even when flows dropped at LWG to 53 kcfs.

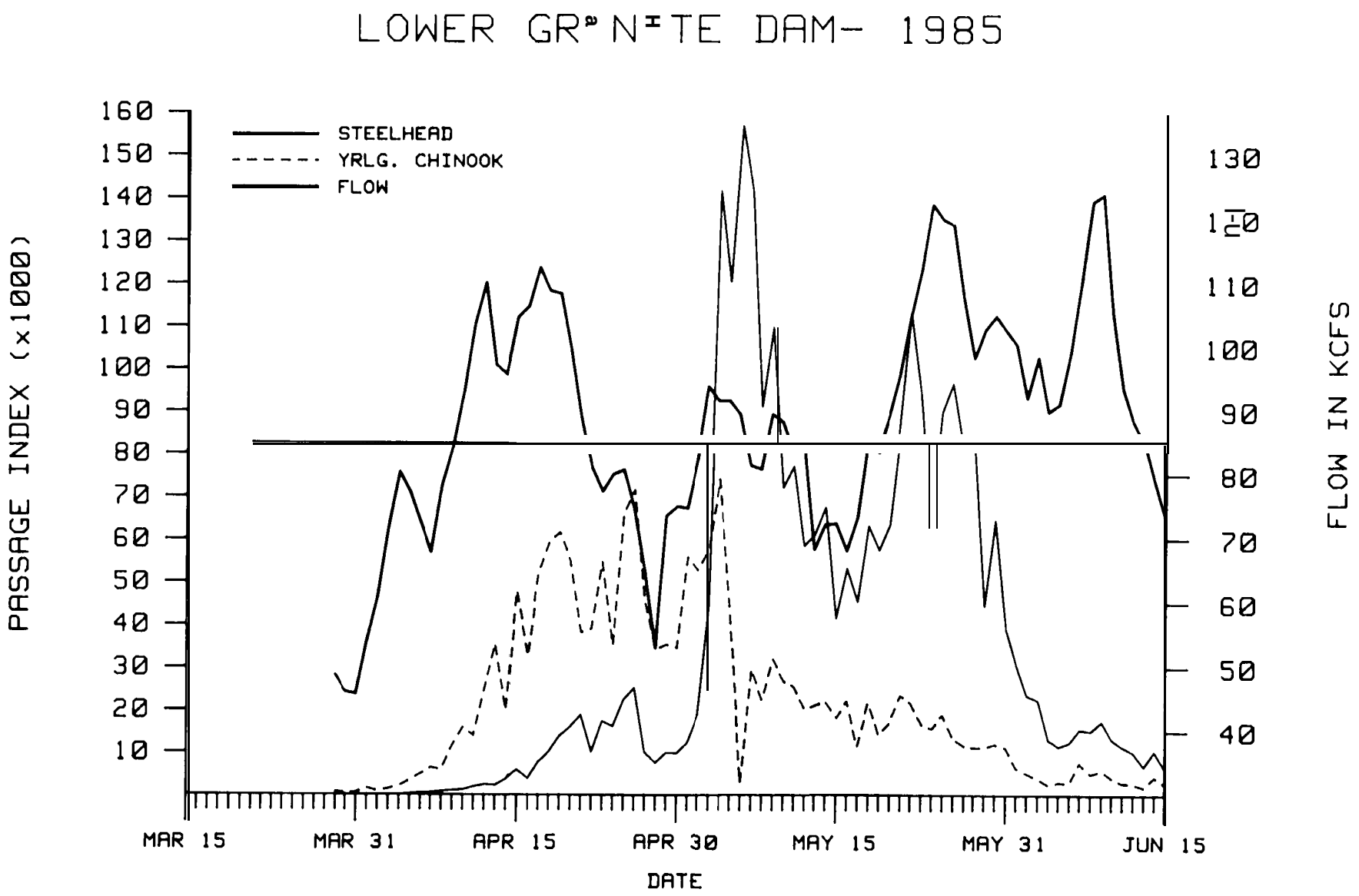

LOWER GRANITE DAM- 1985
STEELHEAD
YRLG. CHINOOK
FLOW
PASSAGE INDEX (x1000)
FLOW IN KCFS
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
130
120
110
100
90
80
70
60
50
40
MAR 15
MAR 31
APR 15
APR 30
MAY 15
MAY 31
JUN 15
DATE

FIGURE 8.

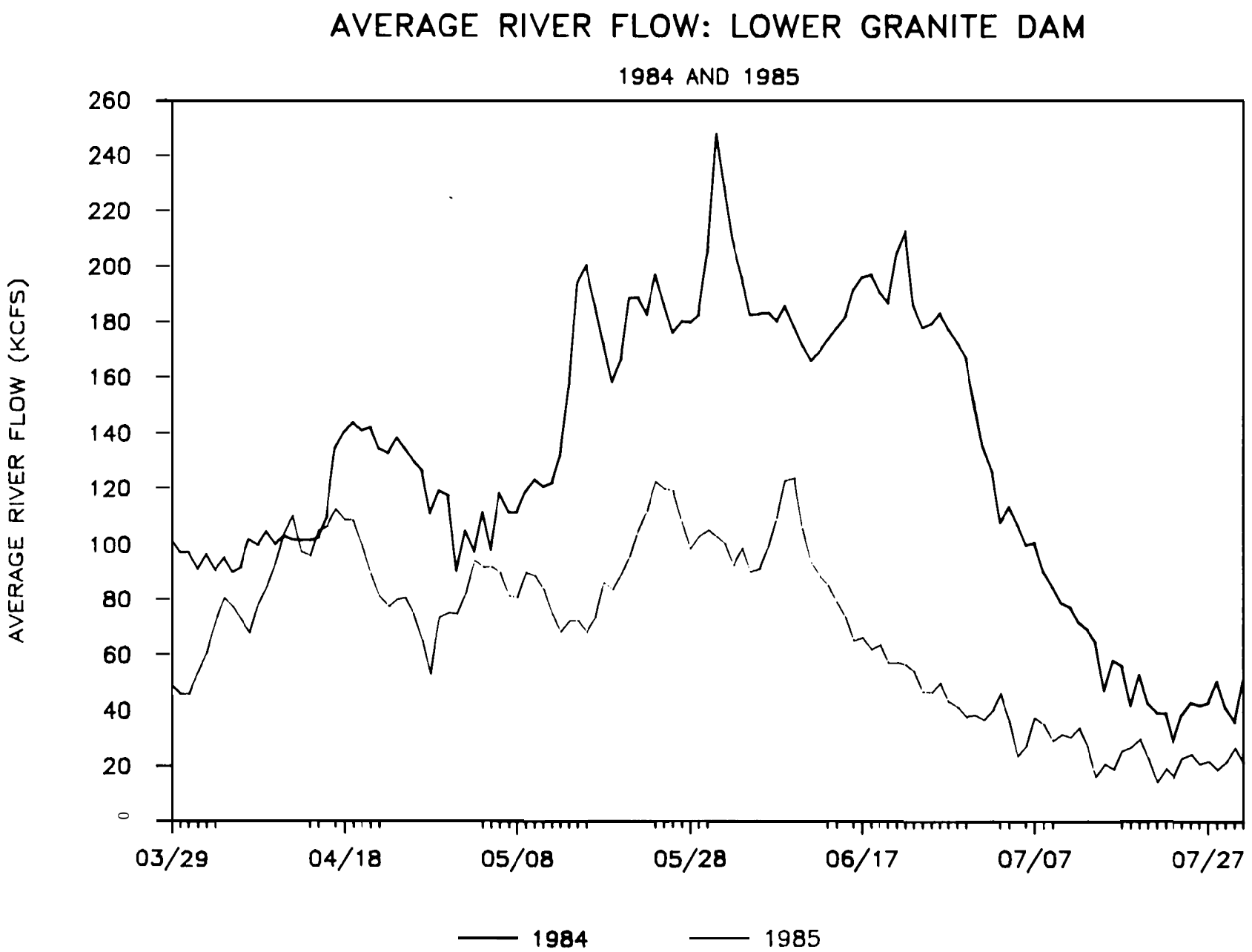

AVERAGE RIVER FLOW: LOWER GRANITE DAM
1984 AND 1985
AVERAGE RIVER FLOW (KCFS)
260
240
220
200
180
160
140
120
100
80
60
40
20
0
03/29
04/18
05/08
05/28
06/17
07/07
07/27
1984
1985

FIGURE 9

In actuality, both Brownlee and Dworshak refilled even ahead of the projected dates. Once filled, both projects began drafting to meet load; Brownlee for normal irrigation load, and Dworshak for a surplus firm energy sale to California.

The flow regime which occurred at Lower Granite in 1985 points out the need to re-examine the water budget agreement presently in place for the Snake River. Under present operations, minimum flow requirements for fish are not being met on the Snake River. Part of the resolution of this problem is the need for:

1. acceptance by the project operators and owners of the Fish and Wildlife Program recommended priorities for water use, which places fishery needs ahead of secondary power marketing and reservoir refill;
2. improvement in forecasting methods because poor forecasts drive the Corps to be very conservative in establishing flood control operations; and
3. Re-examination of the interim flow requirements for fish in the Snake River as specified in the CPO.

Snake River Zero Flows

The Program requires this report to include a discussion of the flows achieved during the calendar year. The following operation was outside the water budget period but occurred in calendar year 1985, and could have had adverse impact to adult salmon and steelhead migrants.

On July 11, 1985 the COE made its first request that the agencies and tribes agree with immediate implementation of winter flow criteria in the Snake River. Winter criteria allows the Corps to go to "zero" night time flow at Snake River projects beginning on December 1. While the reason for this request was never

fully explained, the WBC assumed that the zero flow operation was for purposes of reducing drawsown at Dworshak and Hungry Horse. The two reservoirs were being used to supply water for generation to meet the surplus firm sale to California in late summer and fall.

The agencies and tribes objected to the early implementation of winter criteria due to potential delay to adult migrants. The agencies and tribes were concerned that prevailing warm water temperatures and lower flows could together create adverse migration conditions.

On August 30, 1985, over the objections of the agencies and tribes, the COE authorized zero flow conditions at Lower Granite, Little Goose, and Lower Monumental dams and reduced authorized minimums from 50 kcfs to 25 kcfs during the period 2300-0500. To date, however, these flows have not occurred.

Water Temperatures

Water temperatures reached historical high levels for July at Lower Columbia River and Snake River projects. Smolt mortality at McNary Dam was associated with high water temperatures in the juvenile fish collection system. Figure 10 illustrates temperatures occurring at McMary Dam in 1985, versus temperatures which occurred in the same time period in 1984. River temperatures in 1985 appeared to be two to three weeks ahead of termperatures recorded in 1984.

The Water Budget Managers requested that the COE examine the feasibility of upstream flow releases to mitigate low flow/high temperature problems occurring in the Snake and Lowr Columbia Rivers. The COE has not yet privided its assessment of the feasibility of this sort of operation.

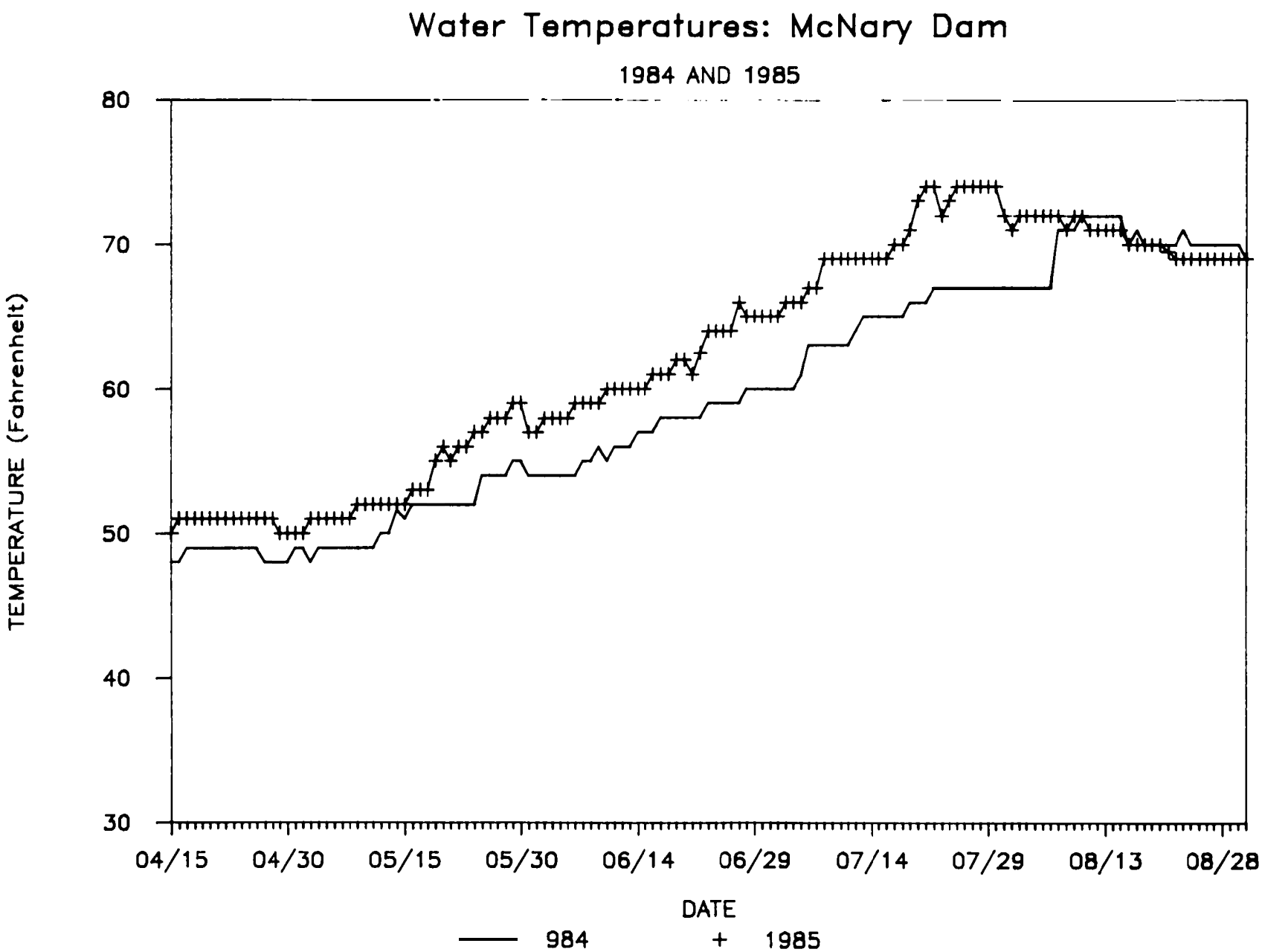

Water Temperatures: McNary Dam
1984 AND 1985
80
70
60
50
40
30
TEMPERATURE (Fahrenheit)
04/15
04/30
05/15
05/30
06/14
06/29
07/14
07/29
08/13
08/28
DATE
984
1985

FIGURE 10

B. Mid-Columbia

In 1984, implementation of the Water Budget surfaced two major problems. The largest problem from the agencies and tribes viewpoint was control and management of the volumes of water defined in the Program. The second problem, which aggravates the ability to manage the Water Budget, is the reference to weekly average flows in the Program discussion of Water Budget accounting. The COE and BPA insisted that the Water Budget be managed to achieve weekly average flows based upon the accounting procedure defined in the Program. The Water Budget Managers, using the implementation wording of the program, requested flows to meet the needs of fish on a three-day written notice, not on a weekly average basis.

To avoid these problems in 1985, all parties agreed to a modified interpretation of the Water Budget. Briefly, it was agreed that there would be a 45-day continuous period in which flows would be provided on a 5-day (week-day) average and that the 2-day (week-end) average would be no less than 80 percent of the previous 5-day average. The agencies and tribes felt that this should obviate the outstanding problems of protection against low flows on weekends and the accounting disagreements. (See Appendix A-Coordinated Plan of Operation)

On April 11, the first Water Budget request for the mid-Columbia was made. This request coincided with the scheduled hatchery releases of spring chinook from Entiat, Leavenworth, and Winthrop, and requested the 5-weekday average to be at least 120 kcfs and the weekend average not less than 80% of the previous 5-weekday actual flow as measured at Priest Rapids. This request had the immediate effect of increasing flows from 60 bcfs to over 120 kcfs to assist the migration of approximately 4 miilion spring chinook **smolts** being released from

the 3 hatcheries. Flows continued at the approximate 120 kcfs level until May 1, when the average was increased to 130 kcfs. On May 6, the average weekday flow was increased to 140 kcfs. Figure 11 is a plot of actual flows received and flows requested. Figure 12 illustrates the adjusted flows, as agreed to in the Coordinated Plan of Operation, for the 45-day period.

Accounting for this year's mid-Columbia Water Budget can be made from Figure 12. With the exception of the first week, April 15 - 19, compliance was obtained with the Water Budget Managers' requests throughout the 45-day period.

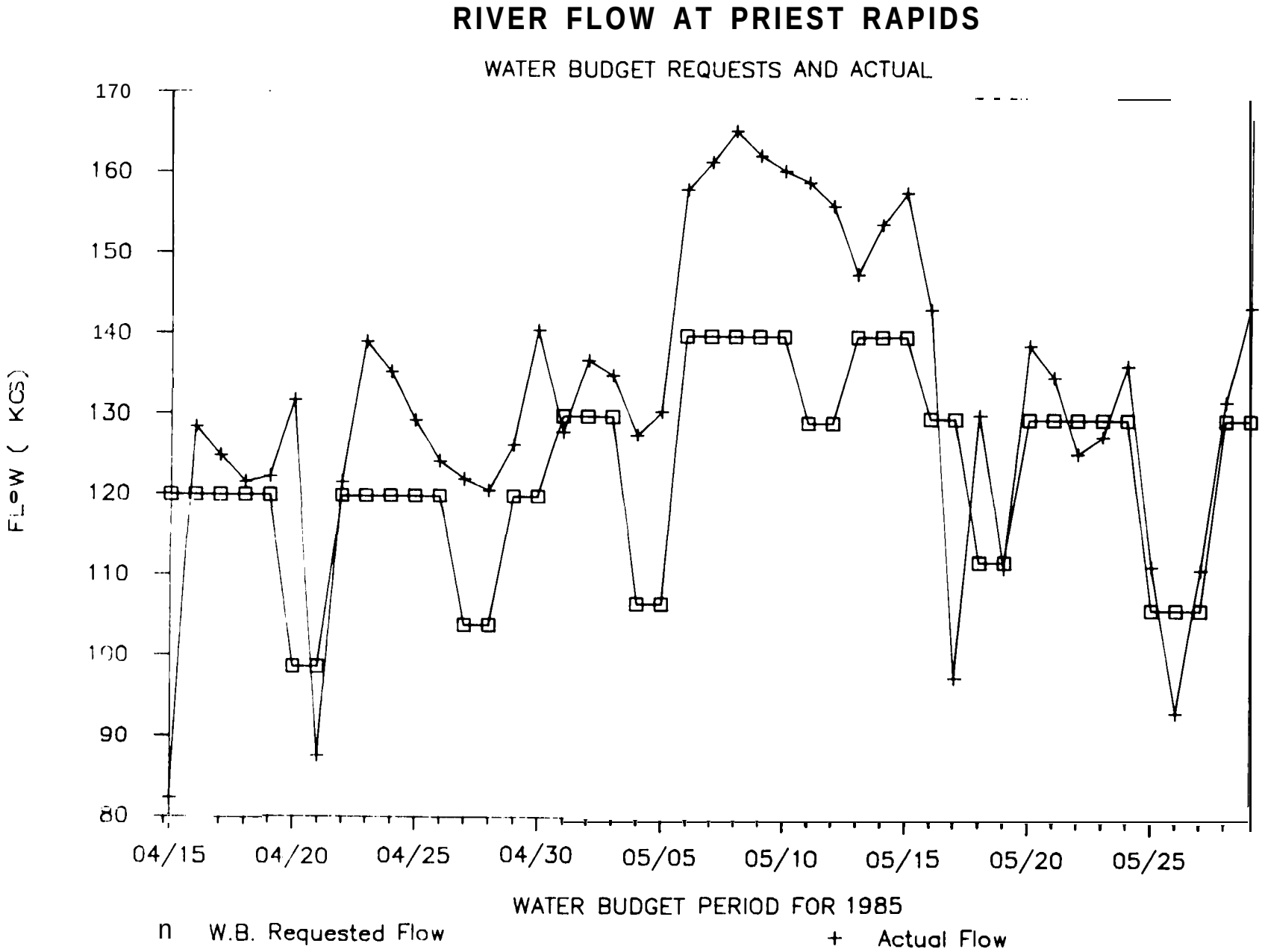

RIVER FLOW AT PRIEST RAPIDS
WATER BUDGET REQUESTS AND ACTUAL
FLOW (KCS)
170
160
150
140
130
120
110
100
90
80
04/15
04/20
04/25
04/30
05/05
05/10
05/15
05/20
05/25
WATER BUDGET PERIOD FOR 1985
n W.B. Requested Flow
+ Actual Flow

FIGURE 1 1

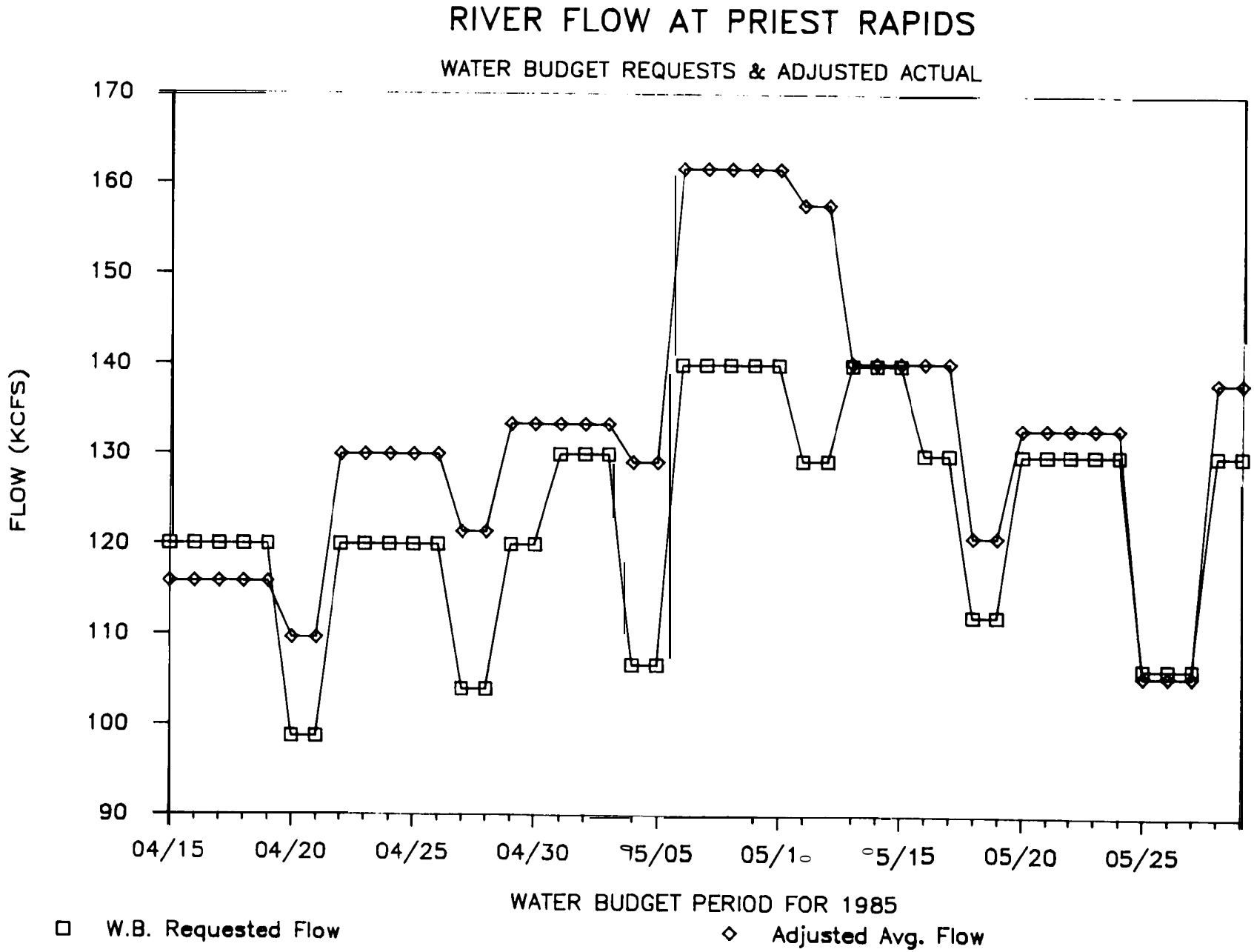

RIVER FLOW AT PRIEST RAPIDS
WATER BUDGET REQUESTS & ADJUSTED ACTUAL
FLOW (KCFS)
170
160
150
140
130
120
110
100
90
04/15
04/20
04/25
04/30
05/05
05/10
05/15
05/20
05/25
WATER BUDGET PERIOD FOR 1985
W.B. Requested Flow
Adjusted Avg. Flow

FIGURE 12

The reduced flow on April 15 was a result of the mid-Columbia PUDs keeping flows high at Vernita Bar on April 13 and 14. Briefly, the PUDs had a flow requirement to protect a high number of redds on Vernita Bar. Maintaining a high level of protection (outflow from Priest Rapids at or above 60 kcfs) was contingent upon Grant County receiving a sufficient level of inflow from the federal system (Grand Coulee and Chief Joseph). The federal system releases were too low during the April 12-14 period, causing Grant County to draft their system to maintain a 60 kcfs outflow. Grant County could have dropped their outflow to 55 kcfs and still have been in compliance with their agreement with the agencies and tribes. With the water budget scheduled to be implemented on April 15, many entities became concerned that this drop in flows for two days during fry emergence was unnecessary, and much discussion ensued between the tribal representatives, BPA, the COE, Grant County, and the agencies. Grant County provided the additional flow for these two days prior to the Water Budget. The water budget release from Grand Coulee commenced at 12:01 a.m. on April 15, and Grant County intercepted a portion of this flow to refill its system. Grant County did not respond to the Water Budget Managers' protest of this action to utilize Water Budget flows to meet other agreements.

Although compliance with the Water Budget Managers' requests was essentially obtained, this operation was not completely successful in terms of fish protection. The Coordinated Plan of Operation was based on the premise that the fish migration would occur over about the same period as for other years. By mid-May, it became obvious to the agencies and tribes that the drawdown of Grand Coulee, due to BPA's agressive marketing of secondary energy, would cause flows to drop to very low levels at the end of the agreed upon water budget period on May 29, to meet refill requirements. In an effort to avert serious impact on

fish migrating down the mid-Columbia, and to avert a serious decrease in lower river flows, the Water Budget Managers initiated discussions with BPA, COE and Bureau of Reclamation (BR). As a result of these discussions, the parties reached verbal agreement that the Water Budget Managers would reduce their flow request, the BR would relax its refill requirement, and BPA would adjust power marketing. All of these actions were intended to maintain flows at Priest Rapids at 130 kcfs through June 15 to protect the protracted migration.

On May 15, 1985 the Water Budget Managers reduced their flow request from 140 kcfs to 130 kcfs as part of the operational agreement. BR waived their requirement that Grand Coulee be at elevation 1240 as they agreed. BPA maintained flows at approximately 120 to 130 kcfs from May 30 to June 6. Without discussion, on June 7 flows dropped while the fish migration indicies were still high at all mid-Columbia monitoring sites and McNary dam. Requests were made that the COE and BPX utilize system flexibility to maintain flows in the 120-130 kcfs range. The requests were denied.

Figures 13 and 14 illustrate the difference between flows in 1984 and 1985 at Rock Island and McNary Dams. At Rock Island 1984 and 1985 flows were fairly close during the month of May, yet substantially lower during the remainder of the period. At McNary, 1985 flows were consistently lower than in 1984. especially during the late spring and summer period.

Summer Flows

Record low flows occurred at Priest Rapids after June 15. Flows through August were lower than the record low flow year 1932. This made 1985 the lowest summer

flows which have occurred in 50 years. The highest water temperatures ever recorded for the mid to end of July time period occurred in conjunction with these low flows.

IV. 1985 SMOLT MONITORING PROGRAM

The Smolt Monitoring Program is developed and conducted jointly by the Columbia Basin Fish and Wildlife agencies and tribes through the Water Budget Managers. This program was established to implement Section 304(d)(2) of the Northwest Power Planning Council (NPPC) Fish and Wildlife Program. The program objective is to develop information for in-season management of the water budget and other system operations, and to determine indices of smolt survival, travel time, and other migrational characteristics.

The data collected in the 1985 Smolt Monitoring Program are preliminary and are being analyzed at the time of this report. This portion of the Water Budget Managers Annual Report is limited to a description of field activities and approach to analysis undertaken in 1985. Complete data reporting and analysis will be presented in the annual report of the Smolt Monitoring Program, which is due on February 1, 1986. Preliminary 1985 smolt migrational data is presented in Section VI of this report.

A. IN-SEASON MANAGEMENT

The Smolt Monitoring Program provided important in-season data for water budget and other system operations management. Monitoring during 1985 added additional information on migrational characteristics for spring, summer and fall chinook and steelhead in the Snake and mid-Columbia reaches.

In-season management data was gathered at several monitoring sites throughout the basin, and communicated to the Water Budget Center via computer terminals. In-season monitoring sites are listed in Table 1.

TABLE 1.

WATER BUDGET CENTER SMOLT MONITORING SITES

1985

Site	Method	Data Gathered
Mid-Columbia		
Rock Island	Bypass Trap	Brands, Species
Priest Rapids	Gatewell Dip	Brands, Species
Snake River		
Whitebird Trap	Scoop Trap	Brands, Species
Snake River Trap	Dipper Trap	Brands, Species
Clear-water Trap	Scoop Trap	Brands, Species
Lower Granite	Bypass/Collection	Brands, Species
Lower Monumental	Hydroacoustics	*Baseline Migration Index
Lower Columbia		
McNary Dan	Bypass/Collection	Brands, Species
John Day Dam	Airlift Pump	Brands, Species
The Dalles Dam	Hydroacoustics/ Gatewell Dip	*Baseline Migration Index

Additional in-season data was obtained from the COE CROHMS data system. This included adult counts, flow, spill, other project operational data, John Day hydroacoustic monitoring, and Little Goose collection counts.

All of these data were reported and compiled daily for use by the Water Budget Managers. These data were also provided upon request to anyone. These data were summarized in a weekly report which was distributed to a mailing list of 175, comprised of public and private utilities, federal and state agencies, Indian tribes, and private individuals.

* Hydroacoustic monitoring at Lower Monumental was Limited in scope, and the reliability of the data is unknown. For this reason, the Corps and BPA determined that the data would be considered first year baseline data, not appropriate or adequate for management. Subsequent monitoring at The Dalles and Lower Monumental is planned to be more complete and comprehensive and more suitable for management considerations. In season data at Lower Monumental and The Dalles was reported 72 hours after it was collected, eliminating its utility for in-season management.

B. MIGRATIONAL CHARACTERISTICS

Determination of migrational characteristics is an important facet of the Smolt Monitoring Program. Consistent monitoring year-to-year supplies a vital information base for operations management and fish protection planning, while providing insight into research needs.

1. Migration Timing and Duration

Timing and duration of the smolt outmigration was determined by calculating the 10%, 50%, and 90%, points of the migration, by species, passed key recovery sites. A migration "index" was calculated from data recovered at the key sample sites; Lower Granite, McNary and John Day Dams. The migration index is the estimated daily collection in the bypass/collection system divided by the proportion of river flow passing through the powerhouse on the same day. This procedure is used to compensate for the change in the proportion of the migration intercepted by the submerged traveling screen bypass system as a result of fluctuating powerhouse operations. This method was also used to determine travel time of marked groups. Migration timing for 1985 is illustrated in Section V of this report in Figure 15 for the Snake River Lewiston Trap, Figure 16 for Lower Granite Dam, Figure 17 for Rock Island Dam, and Figure 18 for McNary Dam.

2. Travel Time

In 1985, indices of travel time for marked hatchery groups in the Snake and mid-Columbia reaches was estimated. Travel time information for these groups will be an annual component of the Smolt Monitoring Program and will appear in the Smolt Monitoring Annual Report to be published in February, 1986.

Travel time is determined by marking fish in hatcheries utilizing freeze branding techniques. Fish were released at hatcheries or at off site locations. Hatcheries, numbers marked and release sites are listed in Table 2.

TABLE 2.

SMOLT MONITORING PROGRAM: HATCHERY 6 RELEASE SITES

1985

Hatchery	Species	Release Site	Number
Snake River			
Dworshak	Sp.Ch.	Dworshak	40,000
Sawtooth	Sp.Ch.	E.Fork Salmon	40,000
Rapid River	Sp.Ch.	Hells Canyon	40,000
Rapid River	Sp.Ch.	Rapid River	40,000
McCall	Su.Ch.	S.Fork Salmon	25,000
Dworshak	SH	Dworshak	35,000
Xiagra Springs	SH	Hells Canyon	30,000
Hagerman	Sh (A)	E.Fork Salmon	40,000
Hagerman	SH (B)	Sawtooth	40,000
*Lyons Ferry	SH	Little Goose	40,000
*Lyons Ferry	SH	below Ice Harbor	24,000
Mid-Columbia			
*Winthrop	Sp.Ch.	Winthrop	105,000
Winthrop	Sp.Ch.	Winthrop	18,000
*Winthrop	Sp.Ch.	Priest Rapids	36,000
Leavenworth	Sp.Ch.	Leavenworth	30,000
*Wells	SH	Pateros	90,000
*Wells	SH	Priest Rapids	36,000
Wells	SuCh	Wells	120,000
Priest Rapids	Fall Ch.	Priest Rapids	80,000

*Groups to calculate survival estimates to McNary Dam.

Indices of smolt travel time were determined from Lower Granite to McNary Dam and from Rock Island to McNary Dam for mid-Columbia marks. The method of calculating travel time was the same as that utilized in 1984 (Smolt Monitoring, Part II, 1984). Statistical error was calculated for the index, as in 1984, to allow statistical comparison between years and flow conditions.

3. Survival

Survival was monitored for three groups which consisted of two mid-Columbia groups (steelhead from Wells Hatchery and spring chinook from Winthrop Hatchery) and one Snake River group (steelhead from Lyons Ferry). The Lyons Ferry group was an addition to 1984 survival monitoring.

Survival was estimated utilizing the same design and analysis that was developed and implemented in 1984. Three replicate test and control groups were released from Wells and Winthrop. Two replicate test and control groups were utilized at Lyons Ferry. Brand data was recovered at McNary Dam for all mark groups.

As was done in 1984, a Biometricians work group* is being utilized to provide review of design and analysis.

Again, as in 1984, survival in the Lower Columbia reach could not be monitored because of a lack of an adequate sampling and collection facility at Bonneville Dam.

*Biometricians Work Group: Chuck Junge, ODFW; Lyle Calvin, OSU; Frank Ossiander, NMFS.

C. DATA MANAGEMENT SYSTEM

1. Purpose and Description

The purpose of the WBC data management system is to provide centralized collection, analysis, and storage of data used in implementing the Water Budget Program. In the future, a central source of fish migrational data will be easily accessible by all interested parties.

The Water Budget Program has two primary data processing requirements. The first component involves in-season management, and requires quick access to real-time (preliminary) data by the Water Budget Managers. The second component is the post-season analysis of the outmigration which requires verified data. These two types of data, termed respectively "soft" data and "hard" data, are obtained through the Water Budget Smolt Monitoring Program, and from outside sources such as the Corps of Engineers (COE), fish and wildlife agencies, public utility districts (PUD), and the tribes.

Soft data includes indices of juvenile and adult migrations, timing and number of hatchery releases, runoff and flow conditions, dam operations, and dissolved gas levels. Current information is accessed daily, and used in managing the operation of:

a. the Water Budget,
b. spill for upstream and downstream migration,
c. spill distribution for nitrogen abatement, and
d. project facilities for upstream migrating adults.

This information is also incorporated into weekly reports; these reports summarize the Water Budget Center activities, and describe factors affecting Water Budget Center decisions on system operations.

Hard data consists of verified and edited smolt monitoring data, hydrologic data, and smolt release information. These data are used in the analysis of smolt migration and the evaluation of the Water Budget.

2. 1985 Program

This was the first year of implementation of the WBC data management system. The central WBC computer system consisted of an IBM System 36 minicomputer and two IBC PC/XT microcomputers located at the WBC. Data used by the WBC was collected, processed, and reported with this centralized system. Data entry terminals (IBM PC's) were located at the remote smolt monitoring sites and used to enter and transfer smolt data to the WBC computer system. The Bonneville Power Administration (BPA) computer (IBM 3081) was used to transfer data stored on magnetic tapes to the WBC System 36. An IBM PC/XT was used at the WBC to access data reports from the COE CROHMS network.

3. Data Collection and Processing

a. Smolt Monitoring Data

Smolt monitoring data was collected, entered and processed for eight monitoring sites. Five sites were located at hydroelectric dams: Rock Island, Priest Rapids, Lower Granite, McNary, and John Day; the three remaining sites were Idaho Department of Fish and Game trap sites (Whitebird, Clear-water, and Lewiston).

Although the sampling scheme varied among the remote monitoring sites, the typical scheme was as follows. Downstream migrating fish were collected at each site for a 24-hour period. The fish were counted and examined to identify the species and determine if the fish were marked. For each fish marked with a

freeze brand, the fish species and the brand symbol, location, and rotation were recorded. At McNary Little Goose, and Lower Granite, the number of fish transported, barged, and trucked were also recorded. In addition to enumeration of fish passage, parameters of flow conditions, sample effort, and sampling conditions were recorded.

The smolt monitoring data were entered, listed, and edited using microcomputer systems at the data entry sites. The data were transmitted through telecommunications from the remote site microcomputer to the WBC 36 minicomputer. Typically, the data were transferred to the WBC the same day of collection. Smolt monitoring data received at the WBC were listed and error checking procedures were run again. When necessary, preliminary data editing was periormed and the data were made available for reporting and analysis.

A variety of smolt monitoring reports were produced using the Data Management System on the WBC 36. Summary reports of smolt passage indices were used at the WBC for purposes of in-season management and were presented in the weekly report. Transportation reports were obtained from the Fish Transportation Oversight Team (FTOT). Reports containing more detailed information on smolt indices nnd brand recaptures were used at the WBC and will be presented in the annual report.

Data files of smolt monitoring data on the 36 minicomputer were translated to PC (microcomputer) files, and PC application software was used to plot and analyze the data. On a weekly basis, copies of data logs recorded at the remote sites were mailed to the WBC and verified with the data residing on the WBC Data Management System. The 1985 smolt monitoring data is still preliminary; final

review of the data by the WBC and remote site contractors is currently in progress.

b. Hydrologic Data

The hydrologic information used and maintained by the WBC includes project discharge, powerhouse flow, spill, forebay and tailwater elevation, and unit usage. Data reports of hourly and average flow parameters were obtained daily from the COE CROHMS network, these data were preliminary and were used for the purpose of in-season management and production of weekly reports.

The WBC is developing an archive of flow data for 15 hydro-projects (Grand coulee, Wells, Rocky Reach, Rock Island, Wanapum, Priest Rapids, Dworshak, Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville). This archive will be used in data analyses and will provide ready access to historic flow data. The COE stored records of hourly flow data on magnetic tape; the data was transferred from tape, through the BPA mainframe, to the WBC 36 minicomputer. The flow data are checked for errors and corrected. Editing of flow data is based on information received from the COE.

Another source of flow data is the smolt monitoring sites. For most smolt monitoring sites, the estimate of fish passage indices is based on the proportion of river flow through the sampling system. To expedite the production of preliminary fish passage indices, flow parameters were compiled at the remote sites and were recorded in conjunction with the smolt monitoring data.

c. Hatchery and Freeze Brand Release Data

Hatchery and freeze brand information maintained by the WBC is identified below. These data were obtained from the fish and wildlife agencies, tribes, and researchers through the mail or through telephone contacts.

1. Agency and hatchery managing the release
2. Fish species and race
3. Release site, river, and major river system
4. Release dates
5. Numbers of fish released
6. Size of fish, indicated as number per pound
7. Brood year and probable year of migration
8. Comments (eg., number of clipped fish)
9. For releases of freeze branded fish:
   Brand symbol, location, and rotation

Prior to the migration season, a list of proposed hatchery releases above Bonneville Dam was compiled and entered onto the 36 minicomputer. The Water Budget Center contacted hatchery release coordinators or hatchery managers on a weekly basis to keep track of and coordinate actual fish releases with the water budget.

The smolt release data base was updated and data reports were produced throughout the migration season. Summary reports of hatchery releases were presented in the Water Budget Center weekly report. Final compilations of hatchery releases will be obtained later this year. The final compilation will be provided in the Smolt Monitoring Reports to be published in February, 1986.

d. Miscellaneous Data: Adult Counts, Dissolved Gas Levels, and Water Temperature

Adult counts, water temperature, and dissolved gas levels were not incorporated directly into the data management system residing on the System 36 minicomputer.

These data were obtained from COE reports (published and accessed from the CROHMS network) and summarized in the weekly and final reports.

Adult migration data obtained from CROHMS included daily and cumulative counts by species at COE and PUD projects. COE reports of adult counts for 1984 and lo-year averages were used for comparison with the 1985 counts. The COE does not maintain the historic adult data for the PUD projects, thus these year-to-year comparisons could not be made for the PUD adult counts.

Water temperatures were obtained from two sources, the CROHMS daily adult count reports and the dissolved gas reports.

D. Coordination of Hatchery Releases

The Water Budget Center continued coordination of hatchery releases with state and federal agencies in the Columbia River Basin. Fishery agencies were notified of when migratory conditions might be most favorable as a result of adequate flows, spills, fishway bypass conditions, and other system operations affecting fish passage.

The Water Budget Managers were able to make flow and operations management decisions based on hatchery releases and their arrival at the mainstem projects. As an example, a release of approximately 15,000,000 tule fall chinook from Spring Creek National Fish Hatchery was made in late February. Spill Request #85-6 was issued in response to this release. The request was for special operations at Bonneville Dam to achieve the 85% passage efficiency goal established at this project by the Sorthwest Power Planning Council. Efforts

were coordinated between the various entities involved to assure that these fish were passed via spill or the Bonneville 1st powerhouse bypass system. This example demonstrates the importance of coordinating special spill and bypass operations to accomodate unscheduled fish releases and atypical seasonal migration patterns.

Approximately 65 million juvenile salmonids were released above Bonneville Dam. Total hatchery releases for 1985 were about 10 million less than 1984's totals (TABLE 3). Releases from the Snake River continue to climb due to compensation hatcheries being completed. Both the mid and lower Columbia hatchery release totals were reduced in 1985; 76 and 86% of the 1984 totals respectively.

The release totals in 1985 are generally from fish releases made during the time frame September 1, 1984 to August 31, 1985. This time frame we believe will give the best picture of fish migrating in 1985. If, for example, sub yearling spring chinook were released in September 1984, they would be included as a 1985 migrant, unless the fish agency recommended that this release group be classified as a 1984 outmigrant. The agency releasing the fish will make the final decision as to the migration year.

PRELIMINARY SUMMARY OF FISH RELEASES BY SPECIES AND RELEASE AREA
FROM 1982 TO 1985

(To be revised when final 1985 counts are available)

River Area	Spring Chinook[1]	Summer Chinook	Fall Chinook, Brights	Fall Chinook, Tule[2]	Coho	Steelhead	Total
1985*							
Snake R.	7,827,104	781,405	1,419,000	0	0	5,939,168	15,966,677
Mid-Col. R.	4,738,133	1,716,650	10,650,000	0	420,000	1,245,288	18,770,071
Lower Col. R.	6,276,516	0	5,178,200	15,522,400	2,288,000	723,015	29,988,131
TOTAL	18,841,753	2,498,055	17,247,200	15,522,400	2,708,000	7,907,471	64,724,879
1984							
Snake R.	8,054,425	356,673[1]	427,191	0	0	6,214,760	15,053,049
Mid-Col. R.	6,129,744	1,240,865	15,548,324	0	517,100	1,422,329	24,858,362
Lower Col. R.	6,398,645	0	3,604,403	20,773,294	3,905,834	534,124	35,216,300
TOTAL	20,582,814	1,597,538	19,579,918	20,773,294	4,422,934	8,171,213	75,127,711
1983							
Snake R.	5,626,000	264,000	115,000	0	0	3,475,000	9,480,000
Mid-Col. R.	4,369,017	1,608,798	12,537,557	0	535,029	1,235,000	20,285,401
Lower Col. R.	4,743,230	0	2,370,249	21,200,000	5,385,004	447,000	34,145,483
TOTAL	14,738,247	1,872,798	15,022,806	21,200,000	5,920,033	5,157,000	63,910,884
1982							
Snake R.	2,657,000	148,000	900,000	0	0	5,300,000	9,005,000
Mid-Col. R.	5,354,641	2,713,266	6,297,241	0	482,510	1,115,000	15,962,658
Lower Col. R.	5,556,645	0	0	21,200,000	4,603,437	352,000	31,712,082
TOTAL	13,568,286	2,861,266	7,197,241	21,200,000	5,085,947	6,767,000	56,679,740

[1] Includes 1983 brood year releases of spring and summer chinook.

[2] 1982 and 1983 Tule Fall Chinook numbers are estimated.

* 1985 IS PRELIMINARY DATA ONLY.

Note: 210,000 sockeye were released 6/84 by LDFG in Stanley and Alturas Lake (Snake River area).

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V. PRELIMINARY 1985 SMOLT MIGRATIONAL DATA

A. Magnitude of the Migration

The Fish and Wildlife Program calls for estimates of the size of the smolt outmigration at Lower Granite and McNary dams. However, presently there is no technique for making these estimates. In the past, estimates of the migration have been made at Lower Granite, McNary and John Day dams using flow efficiency relationships developed by NMFS (Sims, et al. 1984). These estimates contained large error terms, and due to facility modifications which have occurred since the original NMFS work (particularly at Lower Granite), they have been rendered inappropriate as quantitative estimators. No work of this type has been done at Priest Rapids Dam.

To permit year-to-year comparison of the magnitude of the outmigration, the Smolt Monitoring Program has reported an index of total passage by species for several projects. These indices are the annual sum of the daily passage indices (daily collection divided by the proportion of river flow through the powerhouse). The annual passage indices are not estimates of total passage, and thev are not comparable between projects and between species within a year. They are useful for comparing the size of the outmigration between years within a species. This program is intended to be an interim measure until techniques are developed to make exact estimates of the size of the outmigration.

In 1985, total passage indices are reported for Lower Granite, Rock Island, and McNary dams (Table 4). These index the outmigration by species for each major river reach. This is the first year of indexing at Rock Island. Although facilities modifications have been made at Lower Granite in both 1984 and 1985

to study and improve the fish guiding efficiency, the NMFS researchers on the project did not feel that fish guiding efficiency changed appreciably between these years (Krcma, personal communication) so that comparison of the annual passage indices between 1984 and 1985 should be valid. No index is reported for 1985 at John Day Dam because of the incomplete data set and the installation of the submerged traveling screen bypass system in 1985.

TABLE 4. Total Passage indices at Columbia River Projects in 1985, and a Comparison with 1984 Indices.

	1985		1984	
Project	Collection	Index	Collection	Index
Lower Granite				
Yearling Chinook	1,740,746	1,777,561	823,332	1,112,829
Sub-Year. Chinook	44,008	44,769	97,639	132,582
Steelhead	2,689,485	L,819,661	1,114,740	1,589,910
Sockeye	6,467	6,569	11,152	15,803
Rock Island				
Yearling Chinook	32,399	39,294	--	--
Sub-Year. Chinook	21,017	24,540	--	--
Steelhead	30,128	34,573	--	--
Coho	12,037	13,783	--	--
Sockeye	31,201	37,210	--	--
McNary				
Yearling Chinook	2,952,613	3,174,961	1.?61,187	2,085,232
Sub-Year. Chinook	6,562,483	6,791,216	4,098,004	5,348,554
Steelhead	840,493	897,928	610,511	1,051,936
Coho	71,752	73,505	82,144	149,250
Sockeye	1,030,017	1,095,204	191,930	315,313

The most dramatic change in the annual passage indices at Lower Granite occurred for steelhead. The 1985 index is 78% higher than the 1984 index. The estimated collection of steelhead at Lower Granite in 1985 was more than double that in 1984 (the increased collection is also the result of greatly decreased spill levels over 1984). In contrast to this, the total 1985 releases of steelhead from hatcheries above Lower Granite were 4% less than those in 1984.

The yearling chinook passage index at Lower Granite was 60% greater than the 1984 index. The estimated collection of yearling chinook was 111% above the 1984 collection. As was the case with steelhead, the 1985 release of spring chinook in the Snake was 3% less than the release in 1984.

At McNary, the steelhead index for 1985 was 15% less than the index in 1984. This was probably the result of much lesser amounts of spill in 1985 during the steelhead migration period at Lower Granite than occurred in 1984. This resulted in a greater proportion of the Snake River outmigration being collected and transported at Lower Granite and Little Goose. The yearling chinook index at McNary for 1985 was 52% greater than the index in 1984. This was similar to the difference in the yearling chinook index at Lower Granite. As with the steelhead, a higher proportion of the yearling chinook migration in the Snake was transported in 1985 as compared to 1984 because of low spill levels during the migration.

The sub-yearling chinook migration index at McNary for 1985 was 27% greater than the index for 1984. The coho index was about half that seen in 1984, while the sockeye index at McNary was 247% greater in 1985 than in 1984.

Table 4 also illustrates the importance of comparing the migration index, which is corrected for spill levels, rather than the estimated collection. High spill levels occurred in 1984, especially in the Snake, whereas relatively little spill occurred in 1985. As a result, at Lower Granite, the differences in total collection are much greater between the two years as compared to the differences in the total passage index.

B. Smolt Transportation

Relative to 1984, smolt transportation, especially in the Snake, was much greater in 1985. This was the result of very low levels of spill, and consequently very high levels of smolt collection. The 1985 smolt transportation activities will be completely summarized in the annual report from the Fish Transportation Oversite Team. However, the preliminary estimates of numbers of smolts transported are summarized in Table 5.

TABLE 5. 1985

TOTAL SUMMARY SMOLT TRANSPORTATION

	Yearling Chinook	Sub-Year. Chinook	Steelhead	Coho	Sockeye	Total
McNary						
Collected	2,952,613	6,562,483	840,493	71,752	1,030,017	11,457,358
Bypassed	2,051,196	126,321	292,033	8,115	629,499	3,107,164
Trucked	188,849	199,796	12,206	79	1,694	402,624
Barged	713,274	6,211,697	535,504	63,794	392,281	7,916,550
Total Trans	902,123	6,411,493	547,710	63,873	393,975	8,319,174
Lower Granite						
Collected	1,742,244	44,008	2,689,579	0	6,467	4,482,298
Bypassed	7,428	172	5,645	0	0	13,245
Trucked	39,400	34,562	28,297	0	1,057	103,316
Barged	1,690,780	8,255	2,651,693	0	5,359	4,356,087
Total Trans	1,730,180	42,817	2,679,990	0	6,416	4,459,403
Little Goose						
Collected	1,114,640	28,175	1,124,082	0	3,721	2,270,618
Bypassed	195,008	0	52,057	0	715	247,780
Trucked	9,609	25,237	7,889	0	500	43,235
Barged	895,663	1,857	1,065,920	0	2,305	1,965,745
Total Trans	905,272	27,094	1,073,809	0	2,805	2,008,980

As noted in Table 5, a result of the lower spill levels, was that transportation at Columbia basin projects in 1985 was much greater than in 1984. The combined number of fish transported from Snake River projects in 1985 (Lower Granite plus Little Goose) was 2.6 million yearling chinook and 3.7 million steelhead. This represents a 100% and a 37% increase respectively over 1984 levels.

At McNary, transportation of yearling chinook was 208% greater than occurred in 1984, while sub-yearling chinook transportation was up 64%. Steelhead transportation at McNary was 49% greater than occurred in 1984.

C. Smolt Arrival Time and Duration of Migration

1. Snake River Traps

The first indication of fish movement out of the upper Snake system into the hydroelectric system is provided by the traps located on the Clear-water and Snake Rivers near Lewiston, Idaho, and operated by the Idaho Department of Fish and Game. Further details on the operation of these traps in 1985 will be provided in an annual report from Idaho Fish and Game. For the Smolt Monitoring Program, both of these traps provide qualitative information on smolt movement, and the information is largely used for in-season management of downstream projects. In 1985,the Clearwater trap did not supply a continuous record of fish movement because of mechanical problems and high water conditions. The Snake River trap operated throughout the migration, and provided good information on fish movement into Lower Granite Pool.

Sampling at the Snake River trap at Lewiston began on March 16 and continued through September 17 (Figure 15). Yearling chinook passage peaked on April 6. This was 13 days prior to the 1984 peak. Steelhead passage peaked on May 21, 45 days after the yearling chinook peak. The steelhead peak cannot be compared to the 1984 peak, since the trap was removed from operation in 1984 because of high water soon after the first spike in steelhead passage.

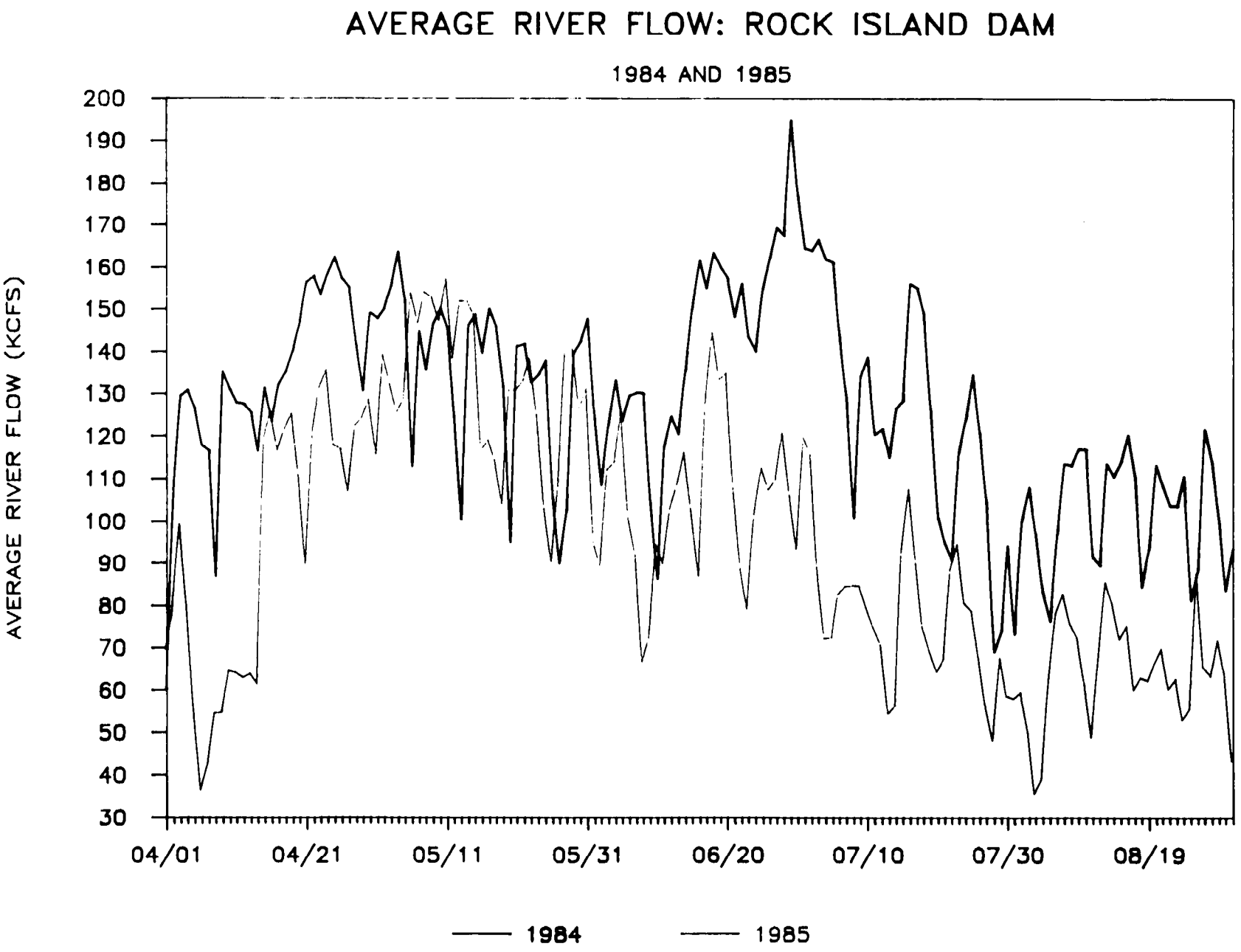

AVERAGE RIVER FLOW: ROCK ISLAND DAM
1984 AND 1985
AVERAGE RIVER FLOW (KCFS)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
04/01
04/21
05/11
05/31
06/20
07/10
07/30
08/19
1984
1985

FIGURE 13

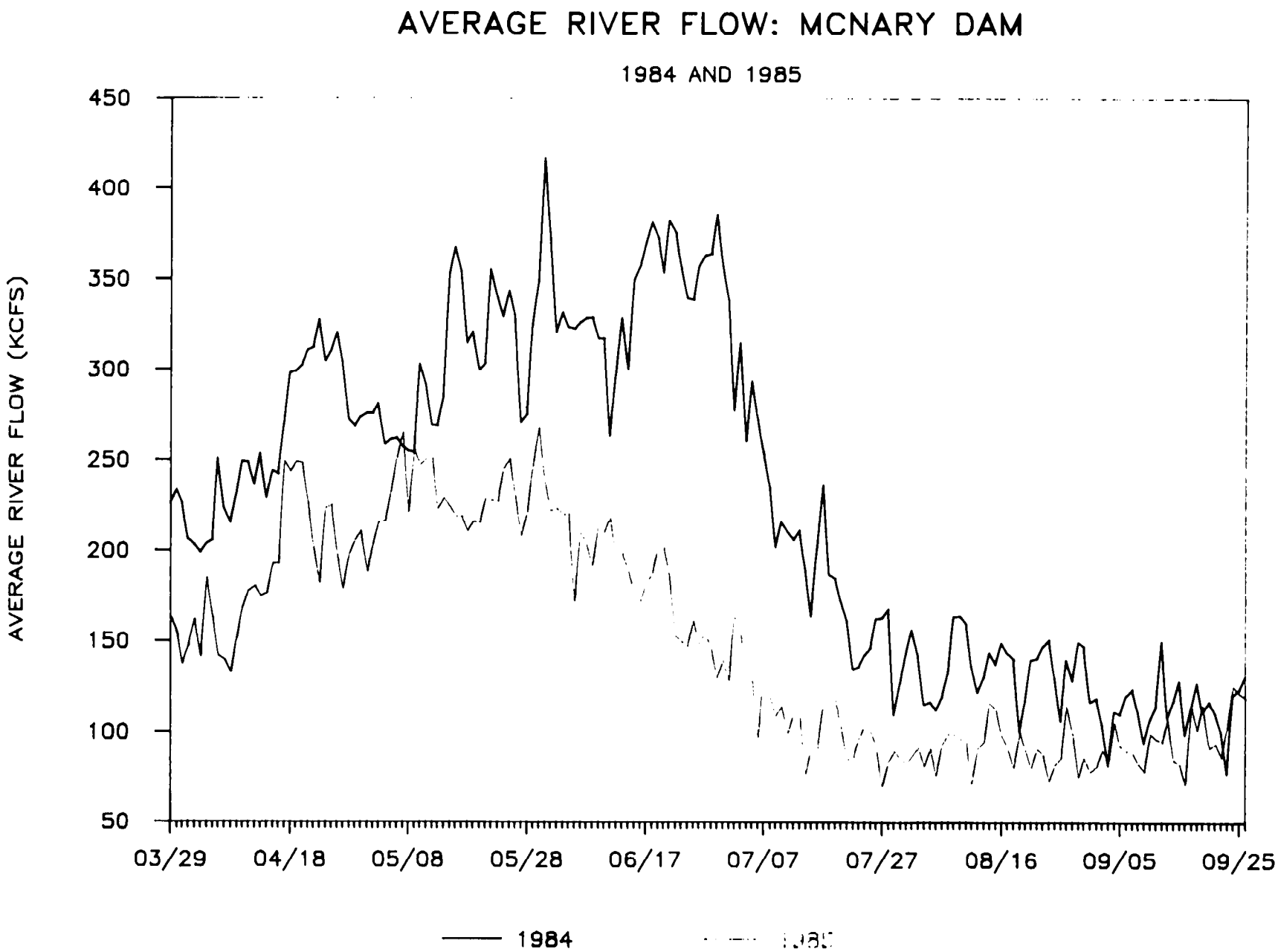

AVERAGE RIVER FLOW: MCNARY DAM
1984 AND 1985
AVERAGE RIVER FLOW (KCFS)
450
400
350
300
250
200
150
100
50
03/29
04/18
05/08
05/28
06/17
07/07
07/27
08/16
09/05
09/25
1984

FIGURE 14

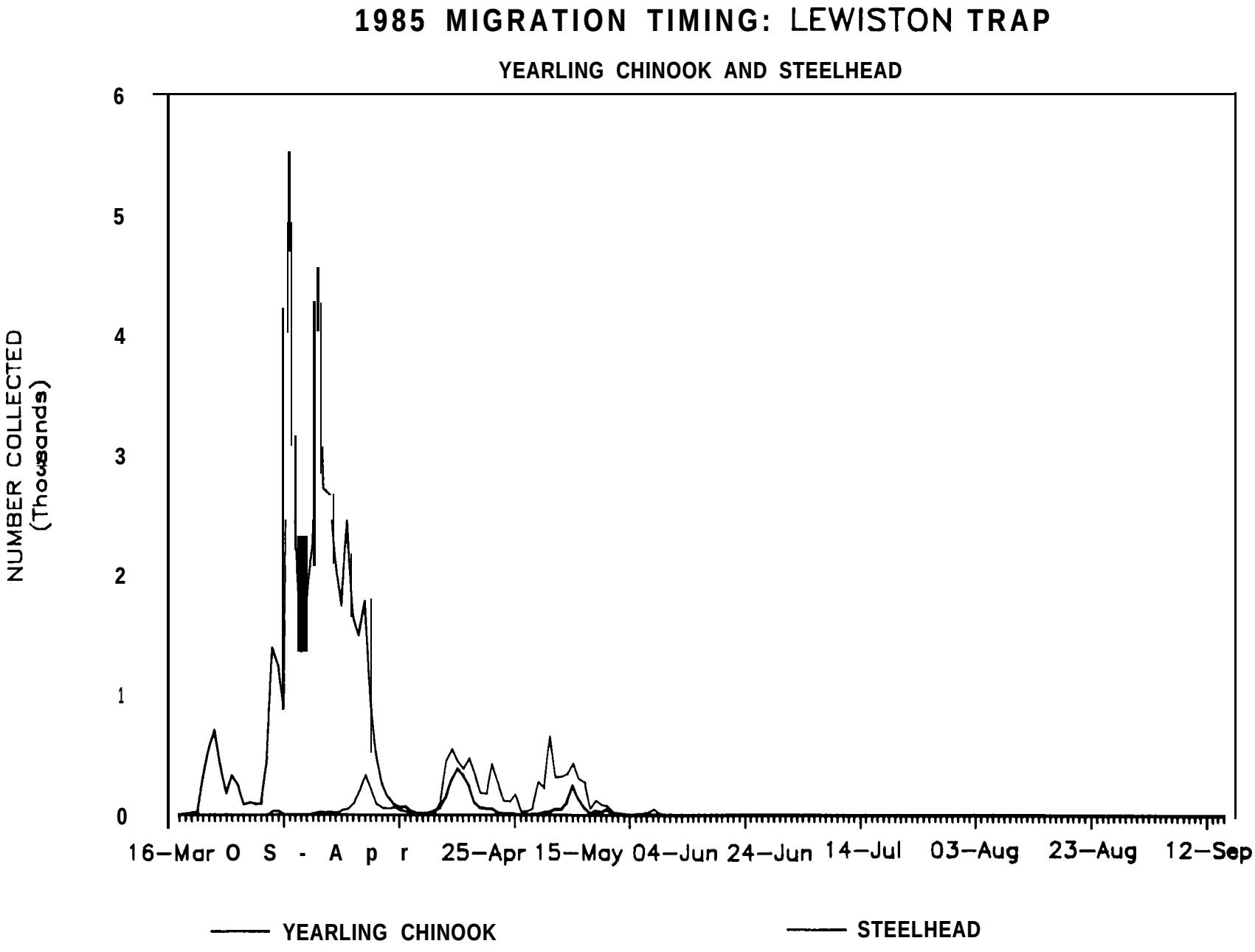

1985 MIGRATION TIMING: LEWISTON TRAP
YEARLING CHINOOK AND STEELHEAD
NUMBER COLLECTED
(Thousands)
6
5
4
3
2
1
0
16-Mar
01-Apr
25-Apr
15-May
04-Jun
24-Jun
14-Jul
03-Aug
23-Aug
12-Sep
YEARLING CHINOOK
STEELHEAD

FIGURE 15

2. Lower Granite

Sampling at Lower Granite extended from March 29 through July 23 (Figure 16). Yearling chinook passage peaked on May 4, sub-yearling chinook peaked on July 9, and steelhead peaked on May 6 (Table 6). In relation to 1984, the yearling chinook migration peaked at nearly the same time, while the steelhead peak occurred nine days early. The sub-yearling peak occurred almost one month later in 1985 than it did in 1984. (This comparison uses the second or true peak in sub-yearling chinook passage in 1984. See discussion below).

TABLE 6. Juvenile Passage Dates at Lower Granite Dam, 1985 and 1984.

	Peak	10%	50%	90%	Duration
			1985		
Chinook Yearling	5/4	4/15	4/30	5/24	39 days
Chinook Sub-Year.	7/9	6/11	7/4	7/14	33 days
Steelhead	5/6	5/3	5/15	5/31	28 days
			1984		
Chinook Yearling	5/2	4/20	5/1	6/10	51 days
Chinook Sub-Year.	6/17	4/25	5/24	6/30	66 days
Steelhead	5/15	4/30	5/15	6/2	33 days

A continuing problem at Lower Granite (and, indeed, at all projects) is the differentiation between yearling and sub-yearling chinook. In the past, size has been the main criteria to separate the two stocks. However, in recent years this has been an increasingly poor criteria, as sub-yearlings have been larger because of hatchery practices, and because of the occasional release of small yearlings to thin out hatchery populations. In 1984, size was the only criteria

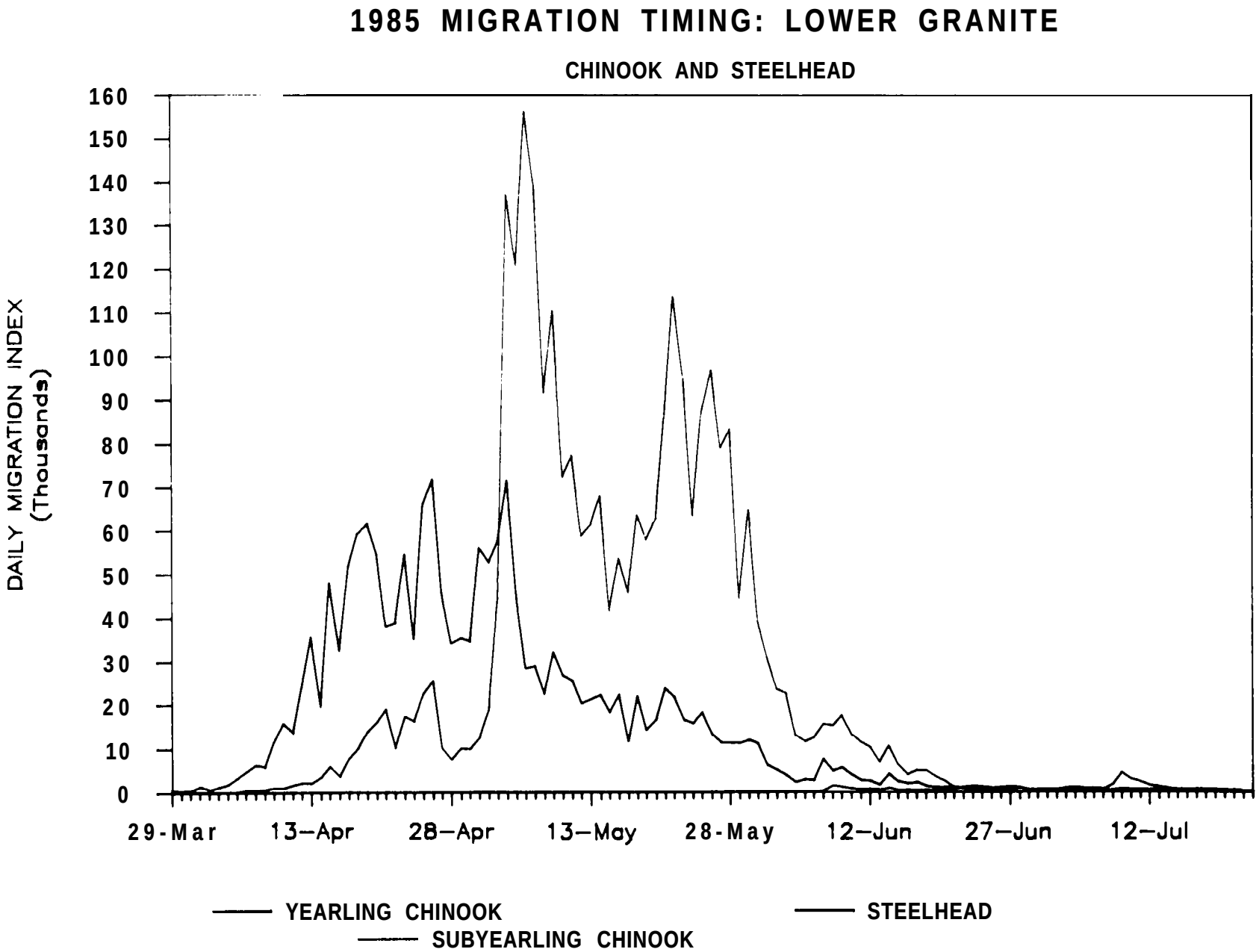

1985 MIGRATION TIMING: LOWER GRANITE
CHINOOK AND STEELHEAD
DAILY MIGRATION INDEX
(Thousands)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
29-Mar
13-Apr
28-Apr
13-May
28-May
12-Jun
27-Jun
12-Jul
YEARLING CHINOOK
STEELHEAD
SUBYEARLING CHINOOK

FIGURE 16

for differentiating the two stocks at Lower Granite. The data from that year show two distinct periods of sub-yearling migration, the first of which occurred simultaneously with the yearling peak. Since this is considerably earlier than would be expected, it was presumed that this first peak in sub-yearlings was actually small yearlings (McConnaha, et al., 1985). In 1985, no firm criteria for separation was established, and the projects were allowed to separate the two stocks as they saw fit (Koski, personal communication). This probably resulted in a combination of size and data as criteria. The Fish Transportation and Oversite Team is presently reviewing the problem of criteria, and will recommend changes in 1986.

As a result of the changing and uncertain criteria for differentiating sub-yearling and yearling chinook, it is difficult to compare the 1985 chinook migration timing to that of 1984. This is especially true for the statistic of percentage passage dates such as the median. Since the peaks in the apparent yearling and sub-yearling migrations are widely separated, the peaks should represent real peaks in the migration and are comparable. This is additionally true because of the great difference in relative magnitude of the stocks.

For steelhead, the 1985 date of median passage was identical to that which occurred in 1984. Duration of the migration was similar in both years.

3. Rock Island

Sampling of the second powerhouse bypass sytem at Rock Island began on March 30 and continued through August 31. Passage dates and duration are shown in Table 7.

TABLE 7. Juvenile Passage Dates at Rock Island Dam, 1985.

	Peak	10%	50%	90%	Duration
Chinook Yearling	4/6	4/16	5/07	5/22	36 days
Chinook Sub-Year.	6/19	6/09	7/10	8/08	60 days
Steelhead	5/23	5/11	5/22	6/02	22 days
Coho	6/04	5/23	5/28	6/05	13 days

The chinook yearling migration at Rock Island preceded the steelhead migration by 15 days, as measured by a comparison of the dates of median passage. The shape of the yearling migration curve at Rock Island closely paralleled the migration pattern of marked chinook from Leavenworth Hatchery. This indicates the strong effect of releases from this hatchery on the passage pattern at Rock Island.

The steelhead passage was much more peaked as compared to the chinook yearling passage (Figure 17). The sub-yearling migration, which to a large extent represents the passage of summer chinook from Wells Hatchery, shows an extended period of migration throughout the summer, with peak passage periods centered around June 18 and July 26.

4. McNary Dam

Saapling at McNary Dam in 1985 began on March 29 and continued through September 26. After this date, the Corps of Engineers continued limited gatewell dipping. Statistics of passage at McNary for 1985 are provided in Table 8 and compared to 1984 statistics.

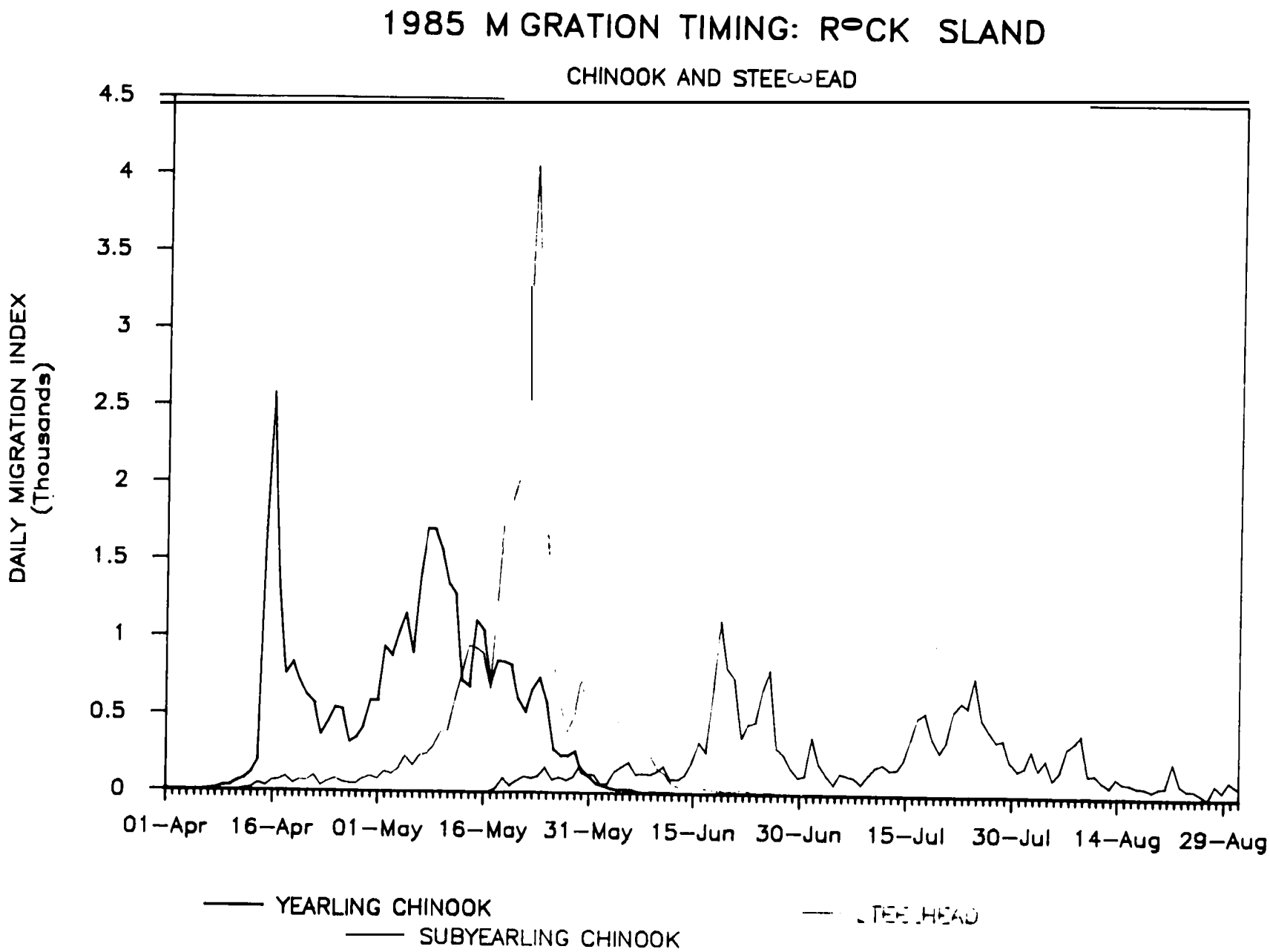

1985 M GRATION TIMING: R CK SLAND
CHINOOK AND STEE EAD
DAILY MIGRATION INDEX
(Thousands)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01–Apr
16–Apr
01–May
16–May
31–May
15–Jun
30–Jun
15–Jul
30–Jul
14–Aug
29–Aug
YEARLING CHINOOK
SUBYEARLING CHINOOK

FIGURE 17

TABLE 8. Juvenile Passage Dates at McNary Dam, 1984 and 1985.

	Peak	10%	50%	90%	Duration
			1985		
Chinook Yearling	5/13	4/11	5/11	5/27	46 days
Chinook Sub-Year	7/13	6/17	7/09	7/24	37 days
Steelhead	5/26	4/25	5/22	6/06	42 days
Coho	6/11	6/03	6/11	6/13	10 days
Sockeye	5/26	4/30	5/20	6/08	39 days
			1984		
Chinook Yearling	5/21	4/23	5/11	5/25	32 days
Chinook Sub-Year	7/17	6/05	7/11	8/06	67 days
Steelhead	5/22	4/27	5/19	6/05	39 days
Coho	5/25	5/19	5/25	6/04	16 days
Sockeye	5/07	5/02	5/16	6/13	42 days

The chinook yearling migration past McNary Dam in 1985 was similar to the 1984 outmigration in regard to the statistics in Table 8. The median date of passage was identical in both years. The 1985 migration was more protracted than the 1984 migration, although some of this was probably the result of the sampling period starting 13 days earlier in 1985. The shape of the yearling chinook migration curve at McNary, however, was unusual in being markedly bimodal (Figure 18). The first peak occurred on April 7, while the second and largest peak occurred on May 13.

The 1985 steelhead migration past McNary was also very similar to the 1984 migration. All three passage index dates were within a few days of the 1984 dates Steelhead passage at McNary in 1985 is illustrated in Figure 18.

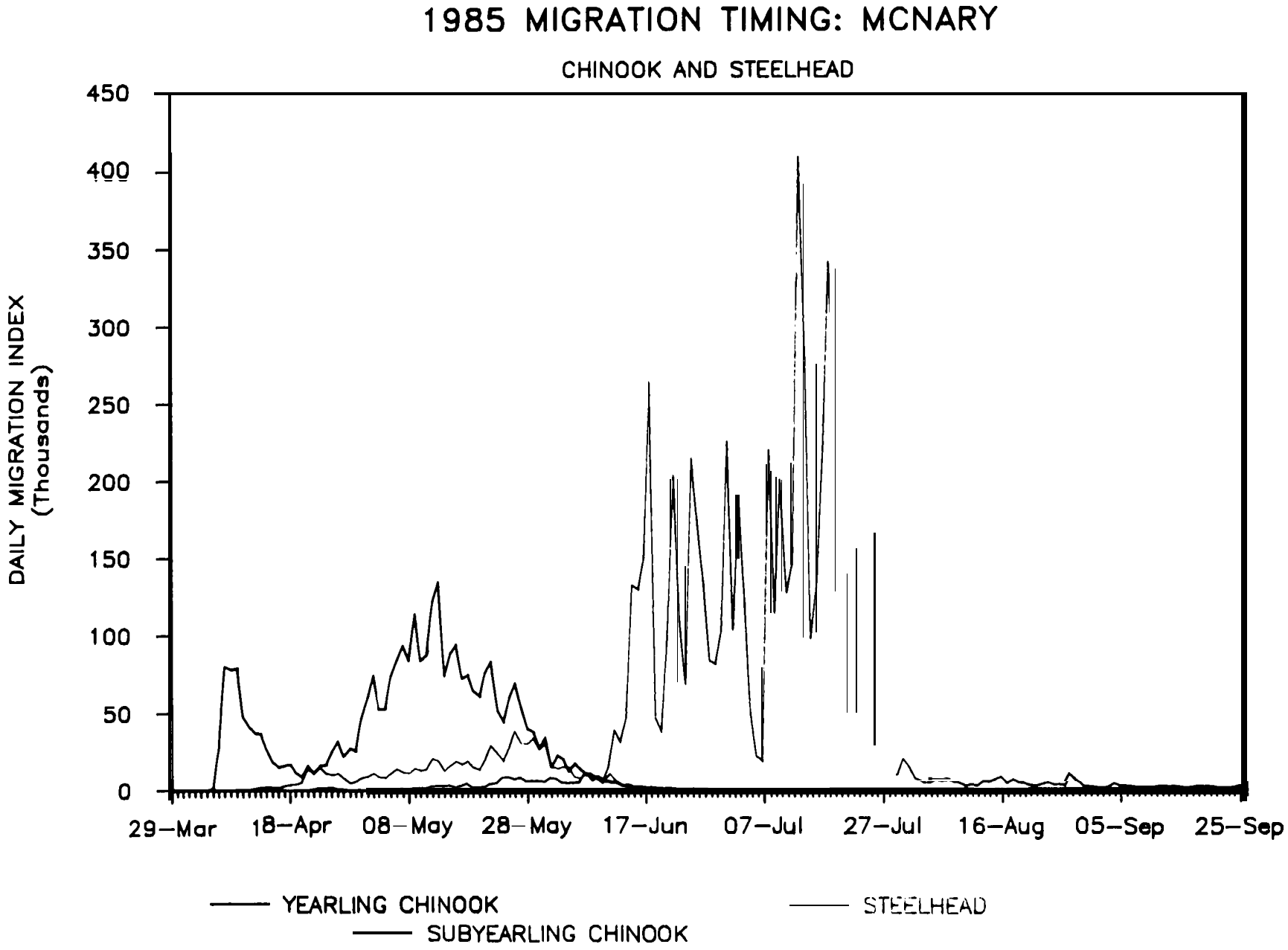

1985 MIGRATION TIMING: MCNARY
CHINOOK AND STEELHEAD
DAILY MIGRATION INDEX
(Thousands)
450
400
350
300
250
200
150
100
50
0
29-Mar
18-Apr
08-May
28-May
17-Jun
07-Jul
27-Jul
16-Aug
05-Sep
25-Sep
YEARLING CHINOOK
SUBYEARLING CHINOOK
STEELHEAD

FIGURE 18

The most dramatic change in the outmigration at McNary occurred for sub-yearling chinook (Table 8). Relative to 1984, the migration was greatly contracted. The 1985 outmigration period was reduced by 44% compared to the 1984 outmigration. In 1985 virtually none of the migration took place after July, while in 1984, a very significant part of the migration occurred in August and early September. Despite this much more contracted migration period, the date of peak passage and the median date of passage were very similar in the two years.

The sockeye migration in 1985 was slightly later than in 1984. Both the median and peak date of passage were later in 1985.

As in 1984, the coho migration was very peaked and brief. The 1985 migration, however, occurred 17 days later than the 1984 migration.

VI. ADULT FISH PASSAGE

A. Adult Fishway Inspections

The purpose of adult fishway inspections is to assure that upstream fish passage facilities are operating according to criteria established for each mainstem dam. Inspections are conducted by state or federal fishery agency personnel at regular or unscheduled dates; generally once per month. Inspection reports are sent to the Water Budget Center, which coordinates unresolved problems with the projects whenever necessary.

B. 1985 Summary

Most major construction or routine maintenance work in or around the adult fish passage facilities is conducted during the winter, a time when relatively few fish are passing through the Columbia River system. Thus, unless a special condition existed, fish ladder and attraction water were operated at full criteria when inspected. On most occasions, the facilities were in criteria. A detailed annual report of project inspections will be published at a later date.

Upstream fish migrants had few delays this year, except during the summer when water temperatures began exceeding 70°F. Spill levels were low this season, and provided no delarys as observed during high spill conditions. With increasing fish runs observed in 1984 and 1985, it is essential that adult passage criteria be adhered to and necessary improvements to fishways be made so that adult fish can migrate to their natal spawning areas with no significant delays at mainstem dams. Coordination by the WBC with participants in the inspection programs, power entities, and interested parties will help provide necessary protection of our natural resource.

C. Adult Run Size

In 1985, adult fish passage counts at mainstem Columbia River dams were on the upswing for most species. At Bonneville Dam, more upstream migrating salmonids were counted than in any preceding year; about 1,000,000 total were counted, a gain of about 20 percent over 1984's total. Returns of steelhead, sockeye and bright fall chinook were at record levels. Coho and spring chinook also showed significant gains, while tule fall and summer chinook were at low levels. A comparison of adult returns at Bonneville, Ice Harbor and Priest Rapids are shown in TABLE 9.

Table 9. A comparison of Columbia River fish counts at Bonneville, McNary, Ice Harbor, and Priest Rapids Dams for calendar years 1985, 1984 and the 10 year average (1975-84).

	1985 [2]	1984	10 year average
Summer Steelhead [1]			
Bonneville	332,700	314,500	158,700
McNary	156,400	131,200	67,900
Ice Harbor	99,900	91,200	46,800
Priest Rapids	32,500	25,500	11,800
Spring Chinook			
Bonneville	91,000	51,000	85,600
McNary	63,300	27,500	37,300
Ice Harbor	33,500	9,100	21,200
Priest Rapids	24,700	12,700	13,000
Summer Chinook			
Bonneville	29,900	28,400	37,000
McNary	22,000	21,200	24,600
Ice Harbor	5,300	6,500	6,400
Priest Rapids	17,300	17,500	17,300
Fall Chinook (Adult Count)			
Bonneville	180,400	147,300	156,200
McNary	79,000	61,000	34,600
Ice Harbor	1,900	1,700	1,400
Priest Rapids	10,200	7,500	5,800
Coho (Adult Count)			
Bonneville	35,800	16,700	25,500
McNary	2,600	900	2,300
Ice Harbor	8	17	254
Priest Rapids	460	130	381
Sockeye			
Bonneville	166,300	152,500	69,100
McNary	98,200	56,900	40,000
Ice Harbor	120	110	240
Priest Rapids	118,500	104,800	59,300

[1] Steelhead counts from June 1 – October 31
[2] 1985 counts thru October 4 and are preliminary data.
Note: All totals greater than 500 are rounded to nearest 100 fish.

VII. CONCLUSIONS and RECOMMENDATIONS

1. The occurrence of large runoff forecast errors, coupled with the manner in which forecasts are used to establish system operational rules, makes it difficult to properly utilize the system flexibility to consistently provide desirable flows for fish passage.

Although 1985 was forecast as an above average runoff year, the actual runoff was below average. Resulting fish passage conditions at times were less than desirable and not as good as could have been provided. Flows were at or below water budget flow minimums for extended periods in the Snake River, and below recommended minimums for the lower Columbia River. Flows were substantially less than flows which occurred both in 1983 and 1984.

Recommendation

All parties affected should jointly undertake a concerted effort to improve runoff forecasting methods, and to provide more flexibility in flood control and operating rule curves developed from such forecasts.

2. The water budget agreement presently in place for the Snake River is deficient because, under present operations, minimum flow requirements for fish are not being met.

The present water budget volume was selected through NPPC deliberations to protect migrating juvenile fish in dry years with a minimum requirement on the basis that system flexibility could provide additional protection in higher flow years. System flexibility could have been used at times in

1985 to provide better passage conditions than those which occurred. However, secondary energy sales and reservoir refill again received priority by the project operators over fish migration needs.

Recommendations

a. Acceptance by the project operators and owners of the Fish and Wildlife Program recommended priorities (Section 304(a)(8)) for water use would help to solve this problem. The Program recommended priorities place fishery flow needs ahead of secondary power marketing and reservoir refill.

b. Improved runoff forecasting methods would allow a less conservative approach to flood control operations than the approach presently being used, especially in the Snake River.

c. The existing interim flow agreements with the COE for Snake River juvenile salmon and steelhead migrants should be re-examined.

d. Further consultations and deliberations should take place with Idaho Power Company (IPCo) for the purpose of designing ways for Brownlee Reservoir to contribute to the water budget. A review of IPCo's FERC license should be made by agency and tribal attorneys for reopening to include water budget flow requirements.

3. Unanticipated high water temperatures in 1985, coupled with low flows, caused smolt mortalities that possibly could have been averted by providing supplemental releases from upstream reservoirs.

Recommendations

a. The COE should complete its examination of the feasibility of upstream flow/high temperature problems in the Snake and Lower Columbia Rivers.

b. The COE should examine relaxing the 95% probability of refill in these extreme cases.

4. The 1985 Coordinated Plan of Operation (CPO) for the mid-Columbia water budget was modified from previous years to address the problem of water budget accounting, which arose in 1983, and the problem of extreme flow fluctuations from weekdays to weekends, which was recognized in 1984. However, 1985 operations illustrated that more water budget management flexibility must be retained by the Water Budget Managers in order to match the highly variable facets of juvenile fish migration.

Recommendation

a. The mid-Columbia CPO should allow the Water Budget Managers to retain the flexibility to make changes in water budget usage as needed throughout the water budget period to protect migrating juvenile salmon and steelhead.

b. Acceptance by project owners and operators of the Fish and Wildlife Program recommended priorities applies here as well as for the Snake River.

c. The need for improved runoff forecasting methods also applies here.

d. Fish and wildlife program clarification should be made through the amendment process on implementation and accounting of water budget.

5. Many problems associated with providing suitable juvenile fish migration conditions stem from a lack of common objectives, resulting in different system operational plans, among the various interests. Since the people responsible for day-by-day implementation are obligated to follow the plan of their respective organizations, it is impossible to

reach agreement on how best to operate the system to provide good fish migration conditions where those plans differ.

Recommendation

The terms "consultation" and "coordination" in the Fish and Wildlife Program as applied to the various components of fish passage planning (i.e. 304(c)(2); 1504, 32.2; 1504, 33.3; and 404(b)) should be defined to mean requiring jointly developed plans agreed upon by all parties, with NPPC providing dispute resolution if agreement cannot be reached.

VIII. APPENDICES

APPENDIX A

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208

March 20, 1985

REPLY TO
ATTENTION OF:
Water Management Branch

Mr. Charles Collins, Chairman
Northwest Power Planning Council
Suite 1100, 850 SW Broadway
Portland, Oregon 97205

Dear Mr. Collins:

I am writing to advise you of our coordinated plan of operation (CPO) for Water Budget implementation for juvenile fish during the period April 15 through June 15, 1985 (Enclosure 1) as requested in Section 304 (c) (2) of your Fish and Wildlife Program.

There has been much effort and numerous meetings working toward developing a plan for 1985 that is acceptable to all interested parties. We have achieved that objective and look forward to a successful juvenile outmigration season in 1985.

Sincerely,

SIGNED

George R. Robertson
Brigadier General, U.S. Army
Division Engineer

Enclosure

NPDEN-[illegible]
March, 1985

COORDINATED PLAN OF OPERATION APRIL 15 THROUGH JUNE 15, 1985

1. Introduction. This coordinated plan of operation (CPO) has been developed by the Army Corps of Engineers in cooperation with Water Budget managers, fishery agencies and tribes, BPA, USBR, utility companies, and others. It is intended that this plan meet in so far as possible the section 304 measures in the NPPC Fish and Wildlife Program relating to the Water Budget for April 15 through June 15, 1985. This CPO relates only to the Water Budget Period and does not include other aspects of operation for fishery. A Fish Passage Plan encompassing other measures to provide for juvenile passage at specific Corps projects is being submitted as a separate document.

2. Runoff Forecasts. A copy of the interagency coordinated March 1 water supply and peak stage forecasts are attached as enclosure 1 and 2 and summarized below for key locations.

Location	Jan-Jul MAF	%	Apr-Jul MAF	%	Est Peak Flow in KCFS
Grand Coulee	59.90	92	53.50	95	---
Priest Rapids	66.40	95	59.50	97	200-260
Brownlee	12.40	131	7.49	135	---
Dworshak	3.38	93	2.86	102	---
Lower Granite	32.40	108	25.10	113	160-230
The Dalles	105.00	98	88.00	102	330-410

3. Reservoir Status. The major Columbia Basin reservoirs have been drawn down for power and flood control purposes but limited storage has been reserved for Water Budget use. Reservoirs are above refill curves (variable energy content curves - VECC) except at Libby, Duncan and Dworshak. Libby has been at minimum outflow since February 13 but is below its assured refill curve because of below normal precipitation in that area in recent weeks. Canadian treaty storage is being operated in accordance with the Detailed Operating Plan, dated September 1984. The following table summarizes the status of the major Columbia Basin reservoirs, and results from forecasts shown in enclosures 1 and 2.

Reservoir	Max/Min Limits MSL	Max Capacity MAF	Elev 2-28-85 (MSL)	VECC 31 Mar MSL	Flood Control Elev MSL	Flood Control Date
Mica	2470/2394	7.0	2414.6	2413.9	2449.2	1 Apr
Arrow	1444/1378	7.1	1385.0	1378.5	1399.9	1 Apr
Duncan	1892/1794	1.4	1804.0	1804.7	1817.8	1 Apr
Libby	2459/2287	5.0	2345.6	2353.0	2361.2	15 Mar
Hungry Horse	3560/3336	3.2	3489.4	3484.4	3499.4	1 May
Albeni Falls	2062/2050	1.2	2151.6	2049.7	2056	1 Apr
Grand Coulee	1290/1208	5.2	1256.2	1223.0	1229.8	1 May
Dworshak	1600/1445	2.0	1462.8	1464.1	1461.4	1 Apr
Brownlee	2077/1976	1.0	2033.5	---	2018.5	1 Apr

4. Priest Rapids Flow Augmentation for Fish. It is planned that augmentation of flows to aid fish movement, primarily hatchery fish, will start no sooner than mid-April and extend for at least 45 days to maximize survival of all stocks, including natural stocks of late migrating species. Refill studies, using the 1985 volume shaped to the 50 year study period, indicate augmented flow should be possible for 45-60 days, while still complying with current power and non-power constraints.

Priest Rapids flow augmentation and implementation described in the following sections are agreed to on a trial basis for 1985 only.

5. 1985 Fish Flow Augmentation Plan. Based on the March 1 volume forecasts of near normal runoff for 1985, weekly average flows of at least 110 to 140 kcfs at Priest Rapids for approximately 45 consecutive days during the April 15 - June 15 period are planned. Flow augmentation will be dependent on minimum flow levels requested by WBC and the actual runoff experienced.

6. Implementation.

a. The Water Budget Managers and advisor shall be represented at the daily COE briefings. The managers will prepare a fishery report for this briefing and deliver it every Thursday throughout the period.

b. The COE and BPA shall make available to the Water Budget Managers all forecasts generated for system planning purposes.

c. The Water Budget Managers will specify the start of the flow augmentation period based on smolt monitoring. The operating week is defined as Monday through Sunday. Averages of the 5-weekday flows requested by WBC, measured at Priest Rapids Dam, will not exceed the following:
(1) 120 kcfs from April 15 - 28.
(2) 130 kcfs from April 29 - May 5.
(3) 140 kcfs from May 6 to end of 45 days from the beginning of flow augmentation but not to extend beyond June 15.

d. Weekend flows at Priest Rapids Dam, including the three-day Memorial Day weekend, will not average less than 80% of the average flow for the previous five weekdays. The average of the four weekdays following Memorial Day will be used to establish the average flow for the following weekend. The cooperation of the mid-Columbia projects will be required to accomplish this regulation.

e. While it is recognized there is no Water Budget requirement at Lower Columbia projects, a 1985 objective for weekend flows will be not to average less than 80% of the average flow for the previous five weekdays during the period April 20 through June 9. Memorial Day weekend will be treated as in (d.) above.

f. The RCC and Water Budget Managers will jointly monitor the runoff and juvenile migration and may, by mutual agreement, modify the minimum level of flow as stated in par. c. above if needed to provide the flow period desired by fishery agencies and tribes.

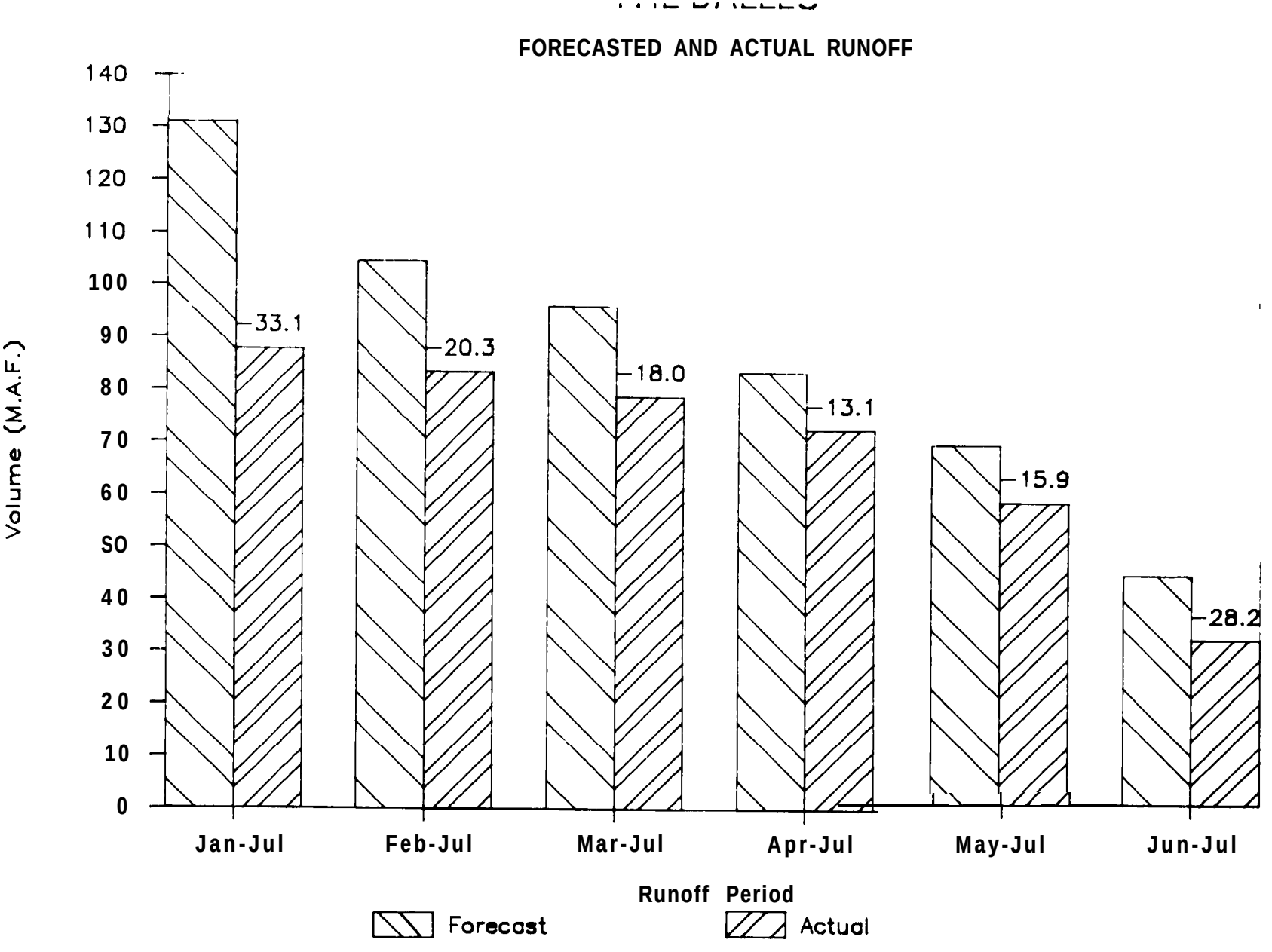

FORECASTED AND ACTUAL RUNOFF
Volume (M.A.F.)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
33.1
20.3
18.0
13.1
15.9
28.2
Jan-Jul
Feb-Jul
Mar-Jul
Apr-Jul
May-Jul
Jun-Jul
Runoff Period
Forecast
Actual

FIGURE 1

Also, spring and summer precipitation has less impact on runoff volume than does winter precipitation.[1]

As shown in Figure 1, the forecast error did decrease through April 1, and then increased in May and again in June.

A major factor not accounted for in the forecasting methods is the fact that the ground was not frozen in much of the upper watershed. This resulted in much of the snowmelt being absorbed by the soil rather than occurring as runoff, as is the more normal case. The NWS is now analyzing the various runoff forecasting error problems.

C. Precipitation

Figures 2, 3, and 4 contain plots comparing monthly precipitation from October, 1984 through September, 1985 with the 20-year average (1961-80) monthly precipitation for the same months. These are shown for the Columbia River basin above Grand Coulee and The Dalles and Snake River basin above Ice Harbor. For all three locations, the pattern is the same--early period (October-November) heavy precipitation, dropping off rapidly in December and January, recovering somewhat during the spring and dropping off again in late summer. Deviation from normal precipitation is largest in January at all three lccations. Lack of early period precipitation appears to have added to the runoff forecast error.

[1]Columbia River Water Management Group, Mtg. So.352 notes, page 6, item 9.

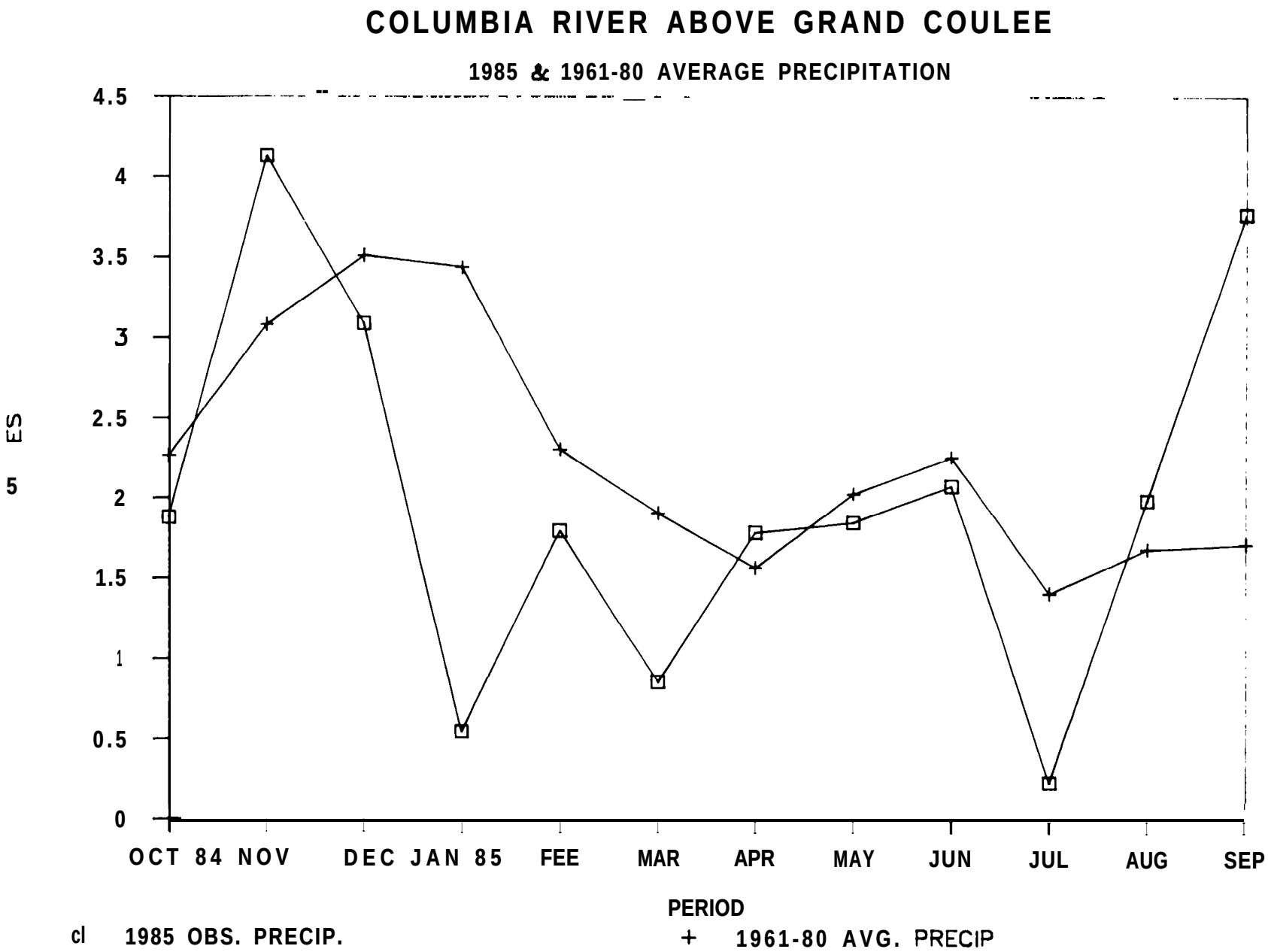
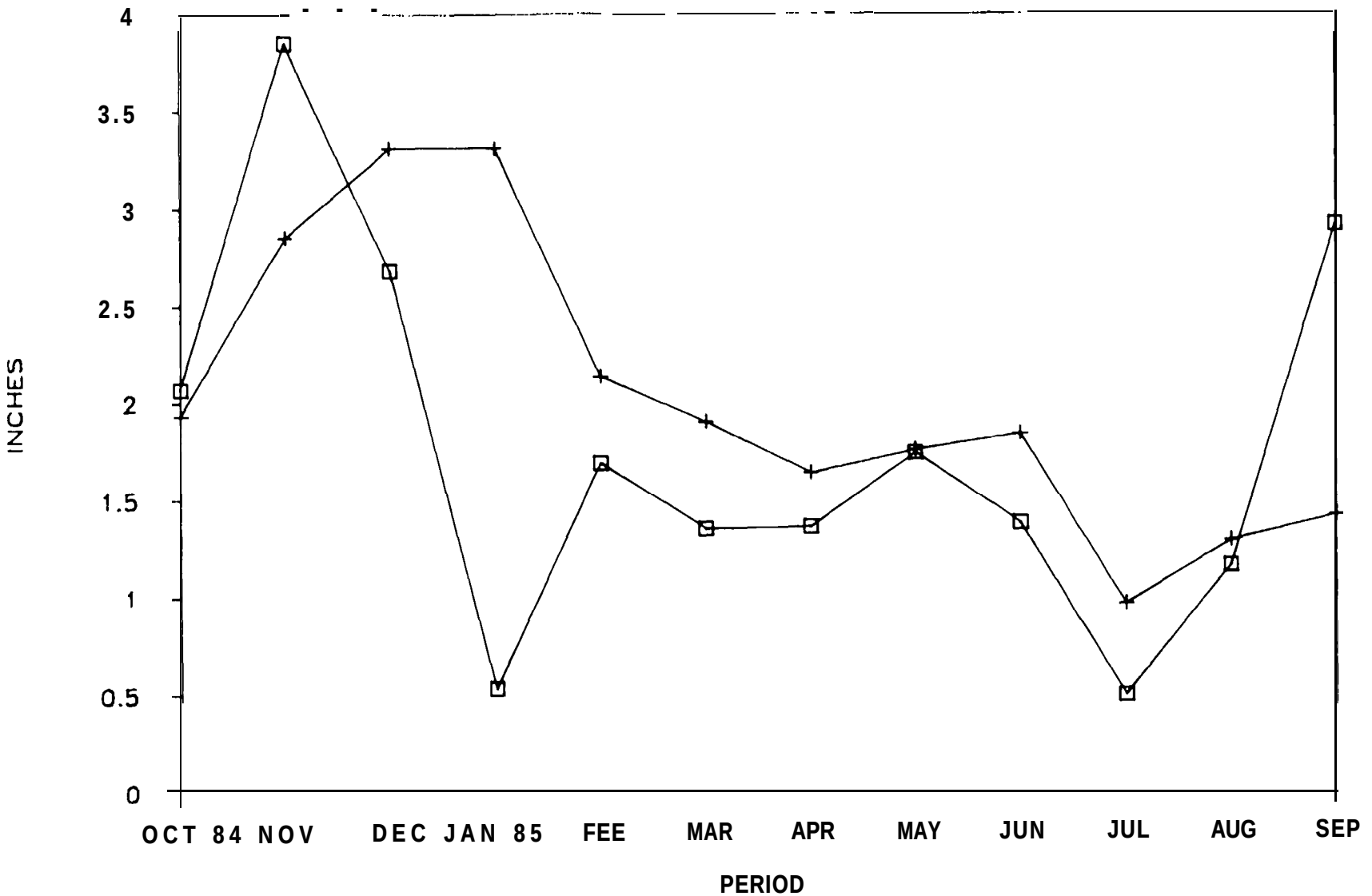

COLUMBIA RIVER ABOVE GRAND COULEE
1985 & 1961-80 AVERAGE PRECIPITATION
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
ES
5
OCT 84 NOV
DEC JAN 85
FEE
MAR
APR
MAY
JUN
JUL
AUG
SEP
PERIOD
cl 1985 OBS. PRECIP.
+ 1961-80 AVG. PRECIP

FIGURE 2

COLUMBIA RIVER ABOVE THE DALLES

1985 & 1961-80 AVERAGE PRECIPITATION



SNAKE RIVER AT LOWER GRANITE

GUIDELINE FOR DETERMINING ON 1 APRIL DWORSHAK OUTFLOW FOR WATER BUDGET USAGE

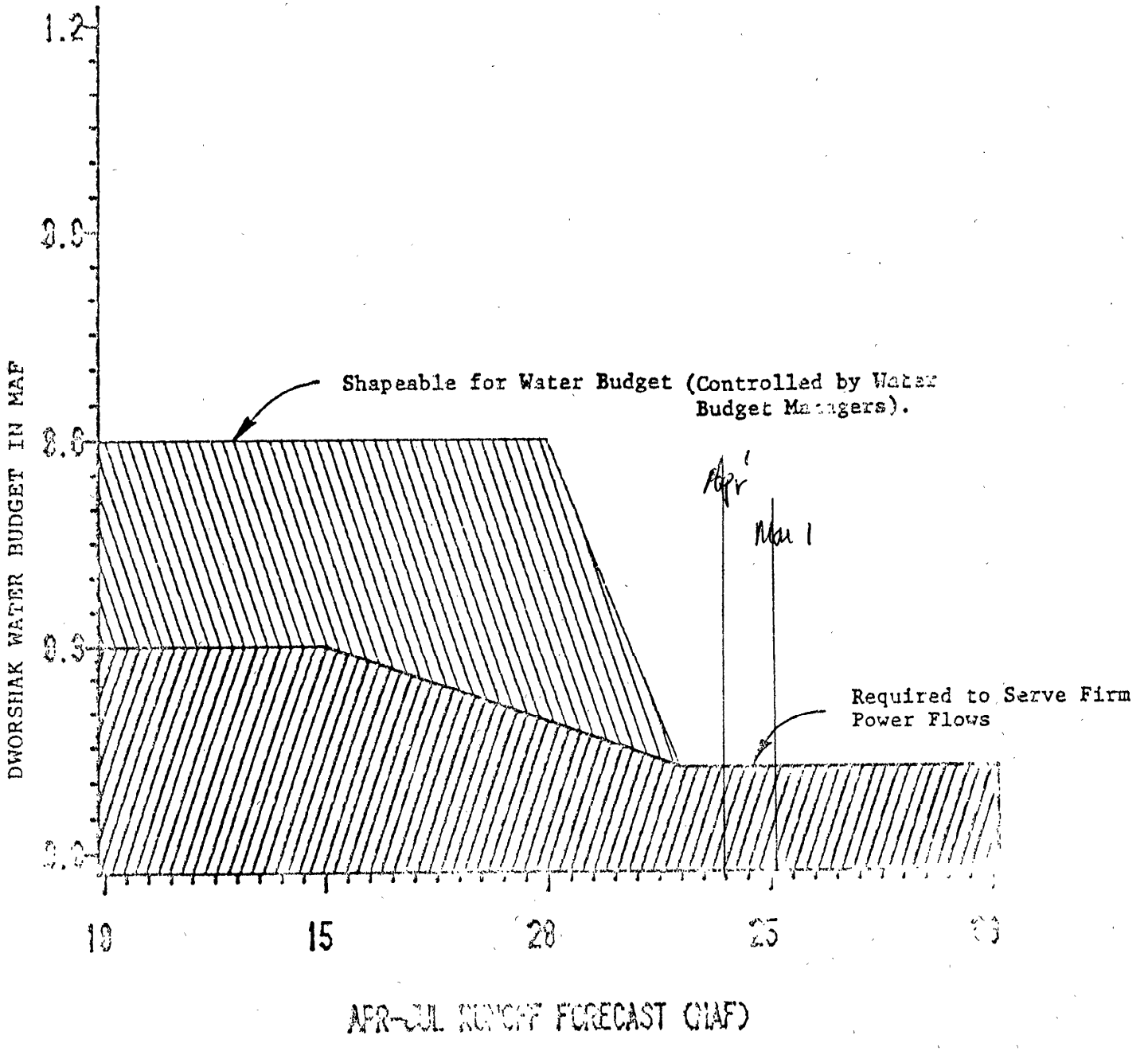


FIGURE 7

1 DEC 83

Encl 3

APPENDIX B

SNAKE RIVER
HYDRO POWER

IDAHO POWER COMPANY

BOX 70 • BOISE, IDAHO 83707

D. E. BARCLAY
VICE PRESIDENT

May 24, 1985

Malcolm H Karr
Mark W Maher
Water Budgtt Managers
2705 E Burnside Street
Suite 213
Portland, OR 97214

Dear Mal and Hark:

The purpose of this letter is to provide you with a written response to the numerous requests Idaho Power Company ("Company") has received to release water f rom Brownlte Reservoir to help satisfy the Water Budget on the Snake River at Lower Granite Dam. The Company has received six (6) telephone requests and one written request.

I received a call from Hark during the week of April 1 29 and the week of May 6 requesting that the Company release water from Brownltt Reservoir to help satisfy the Water Budget. I also received a call from Hal during the week of May 13 requesting that the Company release water from Brownlte Reservoir to help satisfy the Water Budget. In response to each call I stated that tht Company was not in a position to release water to help satisfy the Water Budget at Lower Granite on the Snake River.

The Company al so received a telephone request from the United States Amy Corps of Engineers ("COE") made to Roger Fuhrman in tht Company's operations department sometine during the week of April 22, 1985 (Mr Fuhrman expressed surprise that the CDE would request the Company to release water from Brownlee Reservoir to help satisfy the Water Budget after the COE had required the Company to maintain Brownlee Reservoir at low flood control elevations during the months of March and April); a telephone request from Mark to Robert Stahman in the Company's legal department on Friday, April 26, 1985; (the Company responded to this request when I contacted Mr Maher on Monday, April 29, 1985, stating that the Company was not in a position to help satisfy the Water Budget on the Snake River at Lower Granite by releasing water from Brownltt Reservoir) and a telephone request from Mal to John Pirrong in the Company's planning department on Thursday, May 17, 1985. Finally, the Company received a written request by letter dated May 16, 1985, from the Water Budget Managers addressed to me which I received on Friday, May 17, 1985.

Unfortunately, the Company is not in a position to help satisfy the Water Budget at Lower Granite on the Snake River by releasing water from Brown1 ee Rtservoi r. The following materials explain why the Company cannot release water from Brownlte Reservoir above those rel eases presently planned. However, as discussed below, planned releases have been increased based on the recent increase in inflow resulting from higher precipitation and cooler weather which reduced irrigation withdrawals.

First, I believe it is iqortant to restate the details of the Company's proposal for Water Budget participation on the Snake River as first stated at a Uattr Budget meeting at the CDE building in Portland on March 14, 1984. In attendance at this meeting were the Water Budget managers and repre-stntativts from the COE, the Bonneville Power ministration ("BPA") and other interested parties, including a representative of the Northwest Power Planning Council ("Council").

Under the Company's proposal, when the Company would participate in the Water Budget and the extent of such participation is determined by a number of factors. First and foremost is the fact that BPA must agree to reimburse the Company for generation lost as a result of releasing water from Brownlee Reservoir to help satisfy the Water Budget on the Snake River. While the Company and BPA have not yet finalized such an agreement, the Compnay has assumed, for the purpose of responding to requests for release of water to help satisfy the Water 8udget on the Snake River in 1985, that the Company and BPA would be able to reach such agreement at least for this year. The Company could not participate in the Water Budget without such an agreement. Second, under the proposal, the Company said it would participate in the Water Budget by releasing water from Brownlee Reservoir when the COE's April - July volume runoff forecast as of April 1 for Brownlee is less than median (4.37 million acre feet) and flood control does not have Brownlee Reservoir at or below elevation 2050. The proposal includes commitment levels based on the Brownlee Apri l - July volume runoff forecast as of April 1 at various Brownlee elevations. finally, inflow at Lower Granite must be less than 85,000 cfs and the COE must be releasing 10,000 cfs from Dworshak Reservoir.

On April 29, 1985, when I contacted Mark to advise him of the Company's decision not to release water from Brownlee Reservoir to help satisfy the Water Budget on the Snake River, Brownlee Reservoir was at elevation 2039.40 and the COE's latest SSARR run from Apri 1 24th projected a runoff of 8.4 million acre feet at Brownlee. Based on this informat ion, the Company could *not* participate in the Water Budget by releasing water from Brownlee Reservoi r. Prior to April 29, 1985, Brownlee Reservoir was at even lower elevations. On April 16, 1985, near the beginning of the Water Budget period, Brownlee Reservoir was at elevation 2033.72 and the COE's SSARR run from April 16th projected a runoff of 8.8 million acre feet at Brownlee. These facts do not allow Company participation in the Uattr Budget as stated in the Company proposal.

However, Company representatives have told the Water Budget managers that the Company would consider the release of water from Brownlee Reservoir to help satisfy the Water Budget on the Snake River even if conditions did not fully conform with the Company's proposal. In other words, the Company would do what it reasonably could to help satisfy the Water Budget on the Snake River. The Company, under present operating conditions, expects Brownlee to refill but it is possible it will not refill. Additional releases f rom Brownlee Reservoir to help satisfy the Water Budget would substantially increase the likelihood of no refill. The Company has been able to increase its planned outflow from Hells Canyon based on the recent increase in inflow resulting from higher precipitation and cooler weather which reduced irrigation

withdrawals. Prior to this increase in inflow, the Company had planmd the following release below Hells Canyon.

Hay 18	10,000
Hay 19	10,000
Hay 20-24	15,000

Because of the increase in inflow, the originally planned releases have been increased as follows:

Hay 18	16,600
Hay 19	17,600
Hay 20-24	19,000

The Company would be happy to meet with you and representatives from the COE, BPA and Council to see what, if anything, can be done in the future to help alleviate Water Budget problems in median or above median years, or in years when the volume runoff forecast by the COE was incorrect. It would seem that there must be some way to provide a little cushion in such years. For example, from April 1 through April 24 the Company was required to spill 487,000 acre feet of water at Brownlee for flood control which causes the present concern about refill. The Company had been concerned since February that the volume runoff forecast for Brownlee was high. But all data utilized by the COE indicated a high runoff. The region needs to work together to solve these problems.

Finally, I believe that the facts set forth in this letter illustrate the need to designate contact points, both from the standpoint of who should contact the Company vith Water Budget requests and who within the Company should be contacted. The Company would prefer that all Water Budget requests be made by the Water Budget managers, and that al 1 requests, be made dinctly to me. My telephone number is (208) 383-2292. In the event I am not available, any request should be made to Cliff Bissell, Vice President - Power Plant Construction and Power Operations. Mr Bissell's telephone number is (208) 383-2421.

Sincerely,

D E Barclay

Donald E Barclay
Vice President
Planning and Resources

DEB: jar

cc: Bruce McKay - BPA
Jim Ruff - Council
Larry Wills - Council
Bob Saxvi k - Council
Nick Dodge - COE

APPENDIX C

PJI

Note To Readers:

The following letter was provided in draft to the Water Budget Managers and was not intended to be Bonneville Power Administration's (BPA) published comments on this report. The following correction is noted:

Page 1, paragraph 2: "Report Sections III (B)(l) and [IV] VI should be deleted from the report along with other references to non-Water Budget fish passage operations, such as Vernita Bar Flows and Snake River Zero Flows."

This note has been included in the report by BPA.

PJI

DRAFT

Mr. Mal Karr and Mr. Mark Maher
Water Budget Managers
2705 E. Burnside, Suite 213
Portland, OR 97214

Dear Mal and Mark:

We have reviewed your draft Water Budget Managers Annual Report provided to Bonneville Power Administration (BP?'), in partial fulfillment of contracts for Projects 83-536 and 83-491. Given the draft report was eleven days late, and recognizing your need to submit the final on Novmeber 1, we may provide further comments on the final report.

Section 304 (c)(3) of the Northwest I wer Planning Council's (Council), Fish and Wildlife Program specifies that t e subject annual report is to "1. . ..explain the scheduling of the Wat r Budget and supporting rationale for that calendar year." BPA's contracts, 83-536 and 83-491, require that the report be that specified in Section 304 (c)(3). The draft report, however, includes considerable information irrelevent to Water Budget planning and implementation. This information should not be included in this final report to BPA and the Council. Report Sections III (B)(l) and IV should be deleted from the report along with other references to non-Water Budget fish passage operations, such as Venita Bar Flows and Snake River Zero Flows.

Specific Comments

Page 4, par. 1: The Water Budget does not include "agreed upon" flows of 85 kcfs for a 60-day period in the Snake River. The Water Budget is a volume of water that fishery entities are to manage and shape to improve smolt survival. The 85 kcfs level is a management objective of the fishery entities. The 1985 Coordinated Plan of Operation included a target of 85 kcfs, however, this was based only on the current runoff volume forecast (March 1). As the draft report indicates, this runoff did not materalize, obviating any "required minimum flow."

We recommend the final report, then not represent flows below 85 kcfs as violations of any agreement. This can greatly mislead uninformed readers.

Page 5, par. 2: Again we recommend the final report not represent the existence of "minimum flow requirements" in the Snake River. The volume of water in the Water Budget is to be shaped to meet the Manager's flow plan given specified base power flows.

Page 2, par 1: The Water Budger is "ahead" of secondary power marketing. Marketing of non-firm energy is the means by which the Water Budget is provided. Secondary power marketing did not limit the Water Budget on the Snake River, given the need to provide average weekly flows.

Page 9, par. 1: We recommend the final report not speculate as to BPA's interpretation of the Fish and Wildlife Program. BPA believes the Water Budget allows shaping to meet weekly average flows for fish needs. BPA is not aware of any data which would indicate that meeting weekly average flows does not provide for necessary fish survival.

Page 9, par. 2: Again, the speculation as to BPA's power marketing is erroneous. In above average water years, there is enough water to more than serve secondary power markets.

Page 10, par. 1: The Coordinated Plan of Operation (CPO) did not provide for "guaranteed" flows. The flow levels were predicated on the March 1 forecast, which did not materialize. Additionally, you might mention that had flows occurred as forecast, the CPO would have provided a volume of water larger than the Water Budget.

Page 13, par 2: BPA fully met its obligations under the CPO. Again, the CPO was premised on a predicted runoff that did not occur. "System flexibility" is a vague term that does not guarantee any operation, particularly in a low-runoff year. Low runoff necessitated BPA's termination of FCRPS secondary sales, foregoing surplus firm sales, and even purchase of power to meet firm loads. Reliances on system flexibility

in such water conditions is overly optimistic.

We recommend the Water Budget Managers reconsider their evaluations of the CPO and what it did nor did not accomplish for migrating fish. The Managers, in proposing the CPO, abdicated their flexibility to respond to non-normal runoff conditions and smolt migration in return for a longer period, 45 days, of set flows given forecast runoff conditions. In hindsight, this operation of the Water Budget may not have been that most beneficial to migrating smolts. This was not the fault of the system operators.

BPA is not the agency to meet refill requirements.

BPA did not agree to maintaining higher flows after the Water Budget period. Although by reducing fishery flows in late May, flows were subsequently higher in June than they otherwise would have been.

The report needs to document the "protracted migration" and whether the flows that occured did in fact protect the middle 80 percent of the migration.

Page 14, par. 1 & 2: These paragraphs are very speculative and we believe misrepresent the CPO, system flexibility, and BPA's power marketing. We recommend they be deleted.

Page 59, par. 2: The draft report expounds endlessly on the use of system flexibility. In the future, it would be best to better define the term so all cooperating parties have a clear understanding of what might be expected. Given the early high runoff forecasts, and the subsequent low runoff conditions in 1985, the power system did not have any flexibility to provide higher flows beyond the Water Budget.

Page 59, par. 3: We recommend a review of the Northwest Power Act prior to finalizing the report, particularly as it pertains to the roles of various entities in systems operations. BPA does not believe the fishery agencies and tribal role has been "usurped."

If you have any questions regarding these comments please don't hesitate to call.

Sincerely,

Stephen H. Smith, Chief
Systems Integration Branch

SSMITH:mm:3111:(WP-PJI-6920N)

cc:
J. Palensky - PJ

Official File - PJI